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EDUCATION FOR ALL CHILDREN
WHAT WE CAN LEARN FROM ENGLAND

BY

VICE ADMIRAL H. G. RICKOVER, USN

HEARINGS

BEFORE THE

COMMITTEE ON APPROPRIATIONS
HOUSE OF REPRESENTATIVES

EIGHTY-SEVENTH CONGRESS

SECOND SESSION

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Ap. 1. August 20 1963

PREFACE

Three years ago in 1959, the Committee on Appropriations asked Admiral Rickover to talk on Russian education which he had been studying for some time. This was just after he returned from his visit to Russia as a member of Vice President Nixon's party. The *Report on Russia* containing his testimony evoked a great deal of public interest and response. We had more requests for these hearings than for any hearings in the history of the committee. It was one of the six best sellers. It evoked both praise and criticism.

We have again asked Admiral Rickover to come before this committee to give us his ideas, this time on English education. He has immersed himself in this subject because he believes some of the procedures, practices, and devices the English have developed might prove of help to us. Like ourselves, the English want to keep education decentralized. They, too, do not want a centralized, government-controlled school system. In fact, the British Ministry of Education establishes no school, hires no teacher, prescribes no curriculum, awards no degree. Nevertheless, the English have been able to maintain uniform national scholastic standards in their decentrally managed state education system. This, to the admiral, is their great achievement and he feels that the procedures through which they accomplish this might be acceptable to this country.

He makes a strong case for his belief that we can learn from the English educational experience. He bolsters it by reminding us that we have in the past adopted and adapted much from England and found it good. Our system of justice, our common law, our parliamentary procedure, the safeguards with which we surround the individual to protect him against arbitrary authority—these and many other basic features of our way of life are not unlike basic features of the English way of life. There are enough similarities in English and American political and cultural institutions to give some relevance to the English system of education.

The Admiral brings out the rather striking parallelisms between England's educational problems a century ago and ours today. Her educational facilities at that time were neither adequate to the needs of her rapidly industrializing society nor competitive with education in countries that challenged England's military and political position. Like ourselves, England moves slowly, awaiting the formation of public consensus before radically changing established institutions; as with us today, her competitors were authoritarian countries that could order educational reform by government fiat and thus move ahead much faster. The English procrastinated and we are doing likewise. The admiral argues that we can profit as much by the mistakes England made a century ago as we can profit by the successful way in which she manages public education today.

He shows in detail how the English establish and maintain national standards. He puts the system before us so that we can observe how it works. Among several devices, he suggests that we might like to examine and perhaps copy the way they make use of Government grants to bring about higher educational achievements. He thinks we should follow her example in setting our children a national scholastic goal by providing a variety of permissive national examinations leading to national accreditation of diplomas and degrees. What he has in mind is for Congress to set up a National Standards Committee, a small committee composed of eminent and scholarly persons, who would do two things:

They would keep the American people informed on the state of American education: Does it meet the needs of our times? Is it competitive with education in countries at similar levels of culture and technology with whom we compete economically, politically, or militarily? How do American children compare in academic knowledge with children in Europe or Russia, say at age 12, or 16, or 18; taking, of course, into consideration different ability levels. The Admiral thinks we need an unbiased, disinterested body of intelligent and well-educated people to keep us continually informed on these matters.

The committee would as its second assignment work out various examinations that could be taken by anyone who wished to do so; those who passed successfully would obtain accreditation from the committee. He thinks this would be particularly valuable for certification of teachers, who are unfortunately not as well qualified as we would wish them to be. The committee would in no way interfere with established institutions now granting various diplomas and degrees. It would simply set up a higher standard, offer it to anyone who wished to meet this standard, and accredit those who had successfully done so.

The Admiral believes that the English Certificate of Education examinations offer us a pattern. They are closer to our educational ideas than the maturity or baccalaureate examinations of the Continent. They are far more flexible, since they come at three levels—with a fourth to be added presently; each student can decide for himself how many subjects he wants to take and these will be noted on his certificate. They are of course entirely permissive. The manner in which the examinations are set up seems to him most suitable to our own needs. His proposed Standards Committee would do this cooperatively with schools, colleges, universities, and the existing private examining bodies.

He has given a detailed description of how the English set up their GCE examinations and how they evaluate or mark them. In his opinion they are an eminently fair yet searching means of testing a person's real knowledge and ability. Employers as well as higher educational institutions must be able to find out what an applicant has learned and how well he is able to apply what he has learned to the solution of unforeseen problems. Otherwise, they cannot decide intelligently and fairly whether to accept him.

We in the Congress are fully aware that in the world of today a nation's position is largely determined by the respect accorded its science and technology; preeminence in science and technology as in all cultural matters depends upon a good system of general education. Here quantity is no substitute for quality. A public school system must be open to all children, regardless of the affluence or social circumstances of their parents—this is fundamental to democracy. But it must also be qualitatively first rate. We know that over the past decades the custodial side has been overemphasized and the intellectual side neglected in American education. We know that our schools must raise their scholastic sights. But we are also conscious of the difficulty of giving Federal assistance in education where we have so long depended on local and State initiative.

The committee believes the admiral's comments will be of interest to the American people. The Nation's greatest resource as well as its most cherished treasure is our children. We want them to have the best possible preparation for life. The admiral urges that the best possible preparation a democratic school system can give them is to develop their innate mental capacities through challenging study programs. He pleads eloquently that our nonacademic children need basic education as much as do our abler children. He thinks we ought to set all of them definitive intellectual goals leading to nationally accepted academic rewards. This he feels is the best spur to intellectual effort we can provide.

That our children must be brought to higher intellectual levels is his deepest conviction. Our frontiers are now in the mind. We proved in the past that ordinary men and women were capable of superbly pioneering our uncharted continent; he wants us to prove that our children can be intellectual pioneers as well. But we adult Americans must set them the goal; we must provide the stimulus, the challenge, the atmosphere that will induce children to rise to the best that is in them. The Admiral is never at a loss for an appropriate quote. He calls for support of his program on Jefferson who said: "We must dream of an aristocracy of achievement arising out of a democracy of opportunity."

The committee hopes the Admiral's remarks will stimulate a national debate on the question of whether there shall be set up an agency of some kind to provide permissive national standards by way of national examinations leading to national accreditation of diplomas and degrees.

Clarence Cannon,
Chairman, Committee on Appropriations.

EDUCATION FOR ALL CHILDREN
What We Can Learn From England

Wednesday, May 16, 1962.

WITNESS

VICE ADMIRAL H. G. RICKOVER, CHIEF, NAVAL REACTORS, U.S. ATOMIC ENERGY COMMISSION AND ASSISTANT CHIEF OF BUREAU FOR NUCLEAR PROPULSION, BUREAU OF SHIPS, U.S. NAVY

Mr. Cannon. We have with us this morning not only one of the most indispensable men in national defense but one of the most remarkable men in our history and in world science.

In the last decade or so, Admiral Rickover has found time to make for himself a name both as Director of the Naval Reactors Group which supplies the United States with a nuclear Navy and directs the Shippingport Atomic Power Station program, and also in his chosen avocation of American education. We have asked him to come here this morning to speak in his latter capacity.

Three years ago Admiral Rickover talked to this committee on Russian education, a report that evoked a great deal of public interest and response. We had more requests for those hearings than for any hearings in the history of the committee. It was one of the six best sellers. It evoked both praise and criticism.

He recently wrote a book on Swiss education which has been published by the Council for Basic Education under the title of "Swiss Schools and Ours—Why Theirs Are Better." In an earlier book, "Education and Freedom," and in several of his speeches, he has described Dutch and German systems of education in some detail. Today he will speak on English education, a subject which he has been studying intensively for the last 2 years.

Admiral Rickover's reports do not make comfortable reading for Americans. They dispel illusions about the superiority of our school system which have made us complacent and therefore unaware of the fact that scholastically our position in the world is not what it should be. Our intention has always been to offer all our children the best in formal schooling. To make certain this objective is attained, we must be informed on what school systems in other countries of similar culture and industrial stature accomplish, for how otherwise can we know what is the best?

The Admiral likes to quote the statement of Victor Cousin, who in the 1830's was sent by the French Government to study the school system of France's old rival, Prussia, throughout the 19th century acknowledged to be scholastically the best on the Continent. Cousin recommended to his countrymen that they study the Prussian public school system and adapt its best features to their own needs. "The true greatness of a people," he wrote—

> does not consist in borrowing nothing from others, but in borrowing from all what is good and in perfecting whatever is appropriate.

When Admiral Rickover reported to us on Russian education, it was such a wide departure from his life's profession and his remarkable achievements that we asked him on the record to state his qualifications for talking about education, and here is what he said at that time. You doubtless will recall it, but I will remind you of it again.

> As to my qualifications: I graduated from grammar school, high school, and the U.S. Naval Academy; I took 2 years of postgraduate engineering and received a M.S. from Columbia University, and I spent another year taking a graduate course in nuclear physics and reactor engineering at Oak Ridge.
>
> I was instrumental in setting up the Oak Ridge School of Reactor Technology. I also assisted in setting up the first nuclear engineering course at the Massachusetts Institute of Technology and I am presently on the advisory committee to Princeton University to help them revise their mechanical engineering curriculum. It is true, however, that on the basis of these qualifications, I would not be permitted to teach even a course in "general science" in any grade of the District of Columbia school system, or anywhere else in the United States for that matter. That, of course, would be true also of such eminent educators as Dr. Killian, president of MIT, who was the President's scientific adviser, President Griswold of Yale, President Pusey of Harvard, or President Goheen of Princeton.
>
> "From that standpoint and in the judgment of the National Education Association I am completely unqualified"—he makes a clean breast of it here—"I am completely unqualified to talk about education to your committee, sir. I was forced into the educational problem because I saw the poor products of our educational system. That is what got me started. I am a customer for the products of our schools, I tried to get people to help me do a job in nuclear power development, and I found the product of our schools quite unsatisfactory, so I set out to find the reasons."

Admiral Rickover, we deeply appreciate your being here this morning. We are honored in having you with us. Knowing your heavy work schedule in your proper professional field of nuclear power, some have considered it presumptuous for you to criticize a system built up through more than two centuries and with such beneficent results. Admiral Rickover, may I ask how can you evaluate an entirely different professional field? Leaving aside the question of your "certification" to teach in our schools, I trust it is not an imposition to ask you to tell us how you have the requisite knowledge to criticize our schools?

Admiral Rickover, we shall recognize you, and we will not interrupt you until the close of your statement, when members of the committee will be afforded an opportunity to question you.

Admiral RICKOVER. Thank you very much, Mr. Cannon, for being so gracious as to invite me to talk with your committee. I should also like to thank all the members of this committee, who have always been so kind to me and who have given me so much help. I will be happy to answer questions.

WHO IS QUALIFIED TO CRITICIZE AMERICAN EDUCATION?

The first part of your question, sir, is, how can I, who am not an educator, criticize education, specifically American education?

THE PERSPECTIVE OF A READER

You can inform yourself about *anything* in two ways; by *personal* experience and by *studying* the experience of others. Personal experience is necessarily limited by the kind of life you lead and the kind of work you do. But study of the experience of others is limited only by the time you can find to study, to read, to correspond or to talk with experts. Now anybody can read books. They are available in public libraries and if your own library hasn't got what you want they will even order it for you—free of charge. When he was a young man, Lincoln remarked:

> The things I want to know are in books; my best friend is the man who'll get me a book I ain't read.

We are fortunate that we all have so many friends in our local library.

What you get out of books depends, of course, on how well you choose your authors, how reliable they are. I myself get most of my knowledge of education from official sources: from expressions by education authorities as to what objectives they believe the schools should pursue; writings of educators which give one a good clue to how well or how badly they are educated, and how informed they are on their subject; also school curricula, examination questions and answers, the value given by outsiders to particular school diplomas and higher degrees, and so on. I am fortunate to be in contact by correspondence with eminent scholars and educators here and abroad who are kind enough to give me the benefit of their own wide practical experience and of a reasoned judgment in educational matters that ultimately rests upon their high intelligence and broad general and professional education.

THE VALUE OF OUTSIDERS' JUDGMENT

All this, I know, has no value whatsoever in the eyes of educational officialdom. Like most bureaucracies, this huge organization would like to escape lay criticism and tries to do so by constantly using the stereotyped argument that only "professionals" or "inside" critics can judge the performance of other professionals and anyway, nobody can judge the schools unless he has personally inspected every school in the country, sat in every classroom of every school and listened to every child in every classroom of every school.

Now these are splendid gimmicks if all that the educators want is to save themselves the trouble to answer criticism of the schools. The most effective critics have almost always been outsiders—individuals working on their own, individuals who have no access to public funds that finance junkets of educators around the world. These days they rarely obtain even a foundation grant.

DEWEY VERSUS "BOOKLEARNING"

But I wonder sometimes whether this is merely a gimmick or whether the educators really mean it. I would feel much better if I thought it was only a gimmick, but what I am afraid of is that they actually believe what they say. This is what worries me so much, because if they do believe it, then they are denying the validity of our entire educational system, because all education is based on what humanity has learned throughout history. If you can only learn from what is going on *today*, then obviously we should do away with our educational system and just have our children make field trips to the firehouse and city hall.

It seems to me that the educators are in their own adult lives following the precepts Dewey used for *elementary school children* in his Chicago Laboratory School. He felt that children learned more by practical experience than out of books. Hence his dogma that children should be "learning by doing." For instance, he had 10- and 11-year-olds spend endless hours *reinventing* such things as how to make cotton, flax and wool cloth, how to card wool, and so on. "You can concentrate the history of all mankind into the evolution of flax, cotton, and wool fibers into clothing," said Dewey. But would this not give you an utterly materialistic, worm's eye view of history and of man? And can modern children afford to devote so much time to learning the primitive origins of a manufacturing process that is unlikely to be important in their lives unless they all become managers of textile mills? At that, a manager could grasp the principle of primitive looms in half an hour from a book.

Ordinarily, mistrust of "booklearning" is to be found only among uneducated people who do not themselves read books and whose schooling has not carried them from concrete things to abstract concepts. And so, quite naturally, they feel that to *know*, a person should have personally seen, heard, and touched the things he talks about; and before he can *criticize* anything, he must prove he can do the things he criticizes better himself.

Many people believe that unless a critic can demonstrate a better way, his criticism isn't "constructive." Doesn't the person who reports a fire perform a valuable service, even though the fire department puts it out? You sometimes hear people remark disparagingly of an art or literary critic—to take just one example—that they'd like to see this critic paint a better picture or write a better book. This way of thinking confuses *ability to judge* art with *artistic talent*, but the two are different. If it were not so, no layman could discriminate between good and bad art, or for that matter between a good and a bad doctor, lawyer, or teacher. The "professionals" would then have it all their own way. Many an administrator uses this strategem of requiring his subordinates never to criticize unless it is "constructive," the administrator himself, of course, being the one who decides what is and what is not "constructive" criticism.

JUDGING SCHOOLS BY THEIR GRADUATES

For myself, besides study and reading, correspondence and discussion, I have learned much about education through experience gained on my job with novel engineering development projects. Also, my many years in Washington have given me a unique opportunity to observe how greatly the United States is handicapped because we simply do not have enough people with the educational qualifications essential to keep us progressing satisfactorily. The lack is both in general or liberal education, and in the specialized education needed by professionals and technicians.

As a practical man I am not much interested in the mystique or esoterics of education which fascinate so many of our professional educators. I freely admit I judge schools by their products. Literally thousands of these products pass through my hands and those of my leading scientists and engineers when we interview young people who apply for positions as designers and builders of nuclear reactors or as officers and men to operate our nuclear ships. I find the percentage so qualified to be deplorably small. Those selected we must send to special schools set up and run by our own naval reactors group. These schools do not teach reactor technology alone; they also have to teach many basic subjects which abroad have already been taught in the regular schools. My "school system" of six schools enrolls about 2,500 students at different levels from high school to graduate university. So I can claim some personal experience with educating young Americans.

Mr. Cannon. If I may be frank with you, Admiral Rickover.

Isn't nuclear propulsion a narrowly specialized field? Can you judge American education solely by the educational qualifications of persons who want to work in this field?

Admiral Rickover. How can I, who am engaged in a specialty—nuclear propulsion—qualify as a critic of education? It so happens that this specialty has in it all the elements that go into modern technology. When you find out what it takes to accomplish an engineering project for developing atomic energy you know what it takes to do almost any other new development job. The educational qualifications of the people who do the technical work and of those who direct it as administrators are roughly the same. In fact, our nuclear project is a pretty good touchstone of the effectiveness of our schools. It calls for flexibility and toughness of mind, for understanding the basic principles in physics, chemistry, and all types of engineering. Also for what I'd like to call an impersonal "scientific" attitude toward the work that must be done. This means, first of all, a readiness to go back to fundamental principles, for it is these that must be applied in a novel way to develop a new item such as a nuclear reactor. It requires readiness to shed accustomed routines—nothing new can be created by routine methods. It means on the part of nontechnical administrators, who are set above the technical people doing the actual development work, that they must forget their organizational "status" when it comes to dealing with technical problems. Because here they are inferior in knowledge to the experts who are organizationally their subordinates. It isn't easy for people whose jobs give them power, not to use this power but to respect the imperatives of science and engineering and to bow to the judgment of technical subordinates in *all* technical matters.

BUREAUCRACY, CONFORMITY, AND AMERICAN EDUCATIONAL PHILOSOPHY

Unlike basic scientific research, engineering projects are not self-contained group efforts. By choosing and training the technical people in my organization with utmost care, I have been able to assemble and train an engineering group with high competence in reactor technology. But the country does not obtain full benefit of their broad and long experience, of their spirit of cooperative endeavor and their ability to produce nuclear ships that are ready to go to war immediately after their sea trials. Much of their time is frittered away "educating" a constantly changing stream of administrators and doing the needless paperwork these people order. Once, when a particularly useless report was requested, one that would have tied up a considerable number of engineers for weeks, I demanded to know how thick the report should be, 9 inches, 13 inches, or 17 inches. The 9-inch thick report would require 4 weeks full-time work, the others correspondingly more. As you know, many people judge the value of a report by its thickness. It so happened that right at the time we were having many technical difficulties and not one engineer was available to take care of these—they were all busily writing useless reports.

It is too bad that the "personality cult" and the desire to "manipulate" people rather than to produce useful practical products so permeates our powerful administrators that, instead of helping new projects, they often hinder them. I have never had any technical help from nontechnical administrators. Their human deficiencies are, I believe, a result of the educational philosophy that has permeated the American public school system since Dewey and his followers diverted our schools from traditional objectives and methods into the dead end of life-adjustment, permissiveness, and the use of the schools as social levelers instead of developers of our children's intellectual powers.

The schoolmen could not have thought up a more inappropriate concept of education for this day and age. They could not have dreamed up a worse way to educate young Americans for the tough days ahead. Particularly bad is the excessive emphasis laid in our schools on making oneself popular by conforming to the ways of the "peer" group, on assiduously cultivating an "image" of oneself that will enhance one's status, on personalizing human contacts even when these involve accomplishing tasks which must depend on knowledge and intellectual competence. A generation has grown up that puts "getting along" above competence on the job and above the intellectual courage of sticking by one's considered judgment; especially when it means objecting to orders by superiors whose own judgment may be ill considered since they lack the necessary technical knowledge. There is no surer way to become unpopular than to set oneself against a technically incompetent superior bent on using the power of his position to enforce his will. And though one may do this from the most sincere motives, he will be castigated by everyone as a "controversial nonconformer," and today in this country there is no worse term of opprobrium.

Here is the sort of thing I mean: One day one of my superiors asked that I reduce the amount of radiation shielding in our nuclear ships. He said I was using civilian radiation safety standards but that in military units, personnel casualties of 20 to 30 percent were sometimes accepted. I told him I was sorry I could not do what he asked. I couldn't ignore the fact that where radiation is involved we are dealing not just with the health of the men aboard one ship, but with the genetic future of mankind. The official replied that no one knew much about evolution anyway, and if we raised radiation exposures we might find that the resultant mutations were helpful rather than harmful and that mankind might "learn to live with radiation." You can see what utter nonsense this was. Yet this man had authority. Had I not been obstreperous, had I been a good "organization man," I would have gone along and reduced the shielding and gained favor with him at the expense of some unlucky Navy men and their descendants.

I mention this merely to illustrate how important it is today that we educate our youth to respect the imperatives of science, and to insist on their superiors likewise respecting these imperatives—even at the risk of losing one's job.

I have a legitimate concern with American education simply because I am a citizen of this country and would be derelict in my duties if I did not express my worries over what will happen to our badly educated young people in a world where the United States finds iteself increasingly in competition with other nations—politically, militarily, scientifically, economically, culturally; in fact, in every area of human activity. Besides this, I have a personal concern with American education because my own engineering projects are representative of many that simply must be carried through if our Nation is to remain in top position. These projects are often being harassed and delayed by human deficiencies which a good school system could have done much to prevent.

CURRENT EVIDENCE OF THE NATION'S EDUCATIONAL INADEQUACIES

Naturally, I am aware that many types of human competencies are needed in a complex society. But among these ability to translate new scientific discoveries into useful products is surely one that is of crucial importance at the present time. I have often spoken of the danger in our lengthening leadtimes, especially since leadtime in the Soviet Union has been contracting and in some important items now seems to be shorter than ours. Short leadtimes are a result of skill in planning and carrying through complex new development projects; that is, in recognizing what is needed in personnel, funds, and equipment and providing them in adequate quality and quantity. Essentially, it is a skill that can be deliberately cultivated through proper education, just as the needed personnel can be produced by proper education. Our lengthening leadtimes are therefore an indicator that something is radically wrong in our school system. Whatever other tasks it may have to accomplish, surely a public school system in a country such as ours must develop in youth the kind of intellectual attitudes and abilities that are an absolute necessity if we are to progress technologically, and at a pace at least as rapid as that of competing nations.

That our schools fail in this task has worried me for a long time. As you know, knowledge now doubles every 10 to 15 years; we lack the educated manpower to make full use of the great opportunities this growth of knowledge offers. Also, since we no longer live in geographic isolation from world affairs we suffer in our contacts abroad from a lack of educated manpower to make our national goals effective. We are plagued with serious deficiencies in virtually every class of occupation that makes demands upon a person's general and specialized education, whether it is at the level of the "learned" professional, the semiprofessional, the skilled craftsman, or the technician. Despite our enormous and costly educational establishment, this country has more functional illiterates than most other industrially advanced nations. We have more people who do not possess minimum knowledge of the elements of language, mathematics, history, and geography that are considered part of *elementary education in advanced European countries and which every normal person there appears to* *absorb at school.* Recently, the Army published the fact that 25 percent of draftees were *unqualified* to be modern soldiers—25 percent of a cross section of young America! In most cases the deficiencies were mental. In Switzerland, where every male does military service, the rejection rate is about 7 percent. Swiss standards for draftees are certainly no more lenient than U.S. Army standards. I refuse to accept this appalling difference between rejection rates of 7 percent and 25 percent as reflecting on the intelligence and educability of American youth. I blame American schools for this.

THE NEED TO IMPROVE AND EXTEND EDUCATION OF SKILLED WORKERS AND TECHNICIANS

For a modern industrial nation, it seems to me evident we have too few skilled workers. This shows up glaringly in advanced technologies as nuclear power, missiles, satellites, for here we need precision hardware that cannot be produced by our usual mass production techniques, but requires craftsmanship. We put less effort into systematic education of adequate numbers of skilled workers and technicians than either Europe or Russia. Our high school vocational courses are of little practical use and are positively dangerous when they replace courses in basic education. The modern craftsman—like the professional person—needs a good general education as well as specialized training in his particular craft. We make a mistake in trying to provide both in a "general" school such as our high school. A high school makes the best contribution to the educational needs of future skilled craftsmen when it gives them a first-rate basic education. To teach the innumerable craft skills needed in a modern industrial nation is beyond its capacity. High school vocational courses are bound to lag behind industry's rapidly changing needs. I suggest we examine the diverse postschool apprenticeship and technical school courses—full and part time—by means of which Europe produces proportionally far more skilled workers than do we.

Russia has a tremendous training program for technicians. England's work force is 50 percent skilled, 12 percent semiskilled. Switzerland produces virtually no unskilled labor and must import it from abroad—currently 25 percent of her workers are foreigners. In most European countries there is a shortage of *unskilled* workers; here the shortage is among the *skilled.* A little over a decade ago American educational officialdom, under the sponsorship of the U.S. Office of Education, declared in the so-called Prosser resolution, that our schools could not educate more than 20 percent of their pupils for skilled labor, and another 20 percent for what we call "college preparatory goals." The remaining 60 percent were to be fobbed off with unintellectual life-adjustment training.

Automation was certainly in the air even then. It is incomprehensible that the schoolmen did not foresee what is now so tragically evident to all of us: that workers lacking a good basic education are badly handicapped in learning a new skill when their jobs become obsolete because of automation. The schools, I feel, must share part of the blame that, even while there is a shortage of *skilled* workers and technicians, we have a surplus of poorly educated *unskilled* labor for whom it is becoming increasingly difficult to find jobs. Children who get substandard education will cost State and Federal Governments large sums of money in later years, both through lost taxes and through increased welfare payments.

SHORTAGES IN PROFESSIONAL FIELDS

Our shortage is even greater in the category of "professionals." I need not elaborate on our lack of genuinely qualified scientists and engineers; you are only too well aware of this. Despite efforts to encourage more young people to enter engineering, the Nation's deficit in this field grows steadily. Secretary of Health, Education, and Welfare Ribicoff, reported a few months ago that we graduate each year about 45,000 engineers but need 72,000; he warned that the balance of brainpower may tip dangerously against us if the Nation does not soon awake to the importance of education to the freedom of the Western World. Russia is graduating 120,000 engineers annually.

We have similar shortages in medicine. Currently we graduate about 7,400 physicians. This is just three quarters of our minimum requirement. To fill our doctor gap we import physicians, most of them from Far and Middle Eastern countries. About 8,000 of these are now serving in our hospitals. If these foreign doctors remain here, they will constitute a loss to the countries that paid for their training, a loss these countries can ill afford. This is a shameful situation. It doesn't make sense for us to give billions of dollars to underdeveloped countries and then to take their few trained professionals away from them. This is reverse foreign-aid with a vengeance. It defeats the basic intent behind the program. We are, I believe, the only Western nation that cannot manage to produce enough doctors for its needs. We have a similar shortage in nurses. I read in the papers that we now lure them from Canada. The "professionals" shortage extends into many other spheres. One of the worst deficits, and to my mind the most important, is in teachers.

OUR PHILOSOPHY OF "IDENTICAL EDUCATION" AND OUR TRAINED MANPOWER SHORTAGES

Now all these shortages are in large part a result of our having a public school system with a built-in bias against bright youngsters. We have committed ourselves to an educational philosophy of identical education for all. To provide for the needs of the talented, our educationists constantly tell us, would be "elite" education. This is a loaded word that seeks to engage our emotions and prevent straight thinking. "Elite" education, as I see it, would be education where good schooling can be had only at high cost, thus barring from it the majority of children whose parents could not pay school fees. In the past, education like other amenities of life was a private expense. Children of the rich not only got better education, but also nicer homes, more expensive clothes, better medical care, and all sorts of other things. We have removed education, up to the end of high school, from this list. Most countries abroad have gone beyond us by doing this also for bright students preparing for the professions.

When schooling is tuition free, it automatically ceases to be "elite" education. What you have when you make realistic provision for differing scholastic aptitudes and needs of children is *acceleration* for those who can learn fast. These are the children who are intelligent enough to become professionals. They have to absorb a lot *more education* than the majority of our children. So what on earth is undemocratic about letting them go ahead at their own fast pace so they will not be handicapped by having to postpone overlong the time when they can earn a living?

American "professional" educators can rarely be moved by this argument. To them only *identical* education in a comprehensive school is "democratic." They are not content with eliminating "ability to pay" in our public school system. They also want to eliminate "ability to learn" as a criterion for the kind of education a child pursues. They are not content with equality of *opportunity* in our schools. They want to manipulate schooling so as to cancel out any advantages a child may possess by innate endowment or favorable home background, which would enable him to learn at a more rapid pace than the average. In this way they hope the schools may serve to level out social and economic inequalities which always get muddled in their thinking with *intellectual* inequalities. It seems to them just as "undemocratic" to provide a more challenging academic secondary school for children with academic talent as it is to permit such schools to be so expensive that in effect they are available only to children of the rich.

Their eyes are set firmly on the average pupil. American education therefore moves at the snail's pace of the child of average ability, average motivation, average home background. This is one of the chief causes of our shortage of professionals. Until quite recently the public school system even refused to concern itself seriously with the educational needs of the minority that would go on to higher education.

PROFESSIONAL EDUCATION: THE EUROPEAN SYSTEM AND OURS

Europe, which now shares our ideal of eliminating "ability to pay" as a bar to educational advance, could not possibly afford the educational stretchout we practice as the consequence of our insistence that not only "ability to pay," but also "ability to learn," must be eliminated. I doubt very much that even we will be able to afford the stretchout much longer. Abroad it is considered sensible to allow bright youngsters to proceed through their general education at their own proper pace and to reach the bachelor's or maturity degree in 12 or 13 years. Our bright youth are dragged through the primary school and the high school at a pace adjusted to the average learner. To make up for lost time they must then take an expensive college course, ending up no better educated than their European counterparts but 3 to 4 years older and many thousands of dollars poorer.

For example, our schoolmen's obsession with undifferentiated schooling adds 3 to 4 years to the time it takes to become a physician in this country. *Someone* must pay the student's living costs as well as the cost of schooling during these needlessly imposed additional years. As a result, the number of applicants to our medical schools is currently *decreasing*, yet with a soaring population we need *more* doctors. Since in this country 80 percent of the cost of a medical education must be borne by the student, the school stretchout will inexorably bring us to a point where only children of the rich can afford to become physicians! Even today families with incomes under $5,000 supply only 14 percent of our medical students, yet these families make up

50 percent of the population. Abroad there are not only scholarships for bright students preparing to become physicians; general education is either free or extremely cheap for *all* students. Fees in medical schools are low as well, and the *whole* process takes *3 to 4* years less time than here.

In all professions where the importance of good general education has been recognized and a bachelor's degree is now required for admission to a professional school, our public school stretchout creates severe shortages. In all the professions, where a compromise has been made with the student's desire to get on with specialized training, the stretchout has another unfortunate consequence. I refer to professions where a student may take his specialized training at the college level, entering directly from high school. In such cases, the prescribed college program must attempt to squeeze some general education into an already heavy course of professional studies, to the detriment of the student's professional training. Moreover, little will be done for his general education except to make up for a few of the most glaring gaps. The student will not emerge a genuinely educated person. His counterpart abroad, on the contrary, will be quite as well trained professionally and will *in addition* have obtained a good all-around liberal education, at least equivalent to an American bachelor's degree. The student here and abroad will be about the same age, but the difference in his educational background will be great.

Most professions are studied at the undergraduate level in this country—agriculture, business, elementary school teaching, etc. This was once true of medicine and law as well, but medicine upgraded itself half a century ago, and now the better law schools also require a bachelor's degree for admission. Engineering and a few other professions are in process of upgrading themselves. Meanwhile American professionals who receive only undergraduate training are at a disadvantage compared to Europeans, who have had a much better general education.

SUMMARY: ACHIEVEMENTS OF AMERICAN EDUCATION MEDIOCRE

To sum up: Our schoolmen's bias against giving bright children an education appropriate to their talents and educational objectives has two unfortunate consequences. In professions where we require the members to be educated persons, the needless stretchout produces severe shortages. In professions where we compromise this requirement, Americans will be inferior in educational background to similar Europeans. Doubtless the reply will be "but we like it this way." There was a time when we could afford to say this; when we could set lower educational requirements without suffering any great damage. But that was when we lived in isolation and didn't have to meet competition from abroad. Today we simply must see to it that our people are educationally equipped to hold their own in every sphere of human activity.

As it is, many of our brightest people who have attained positions at the top of public and private enterprise, in administrative as well as in technical or professional work, lack the foundation of a broad and thorough education in the humanities and the sciences. Without this foundation they become what the Spanish philosopher Ortega y Gasset "calls learned ignoramuses"—persons who know much about a narrow specialty and little about all else; persons who, in dealing with each other, lack a common medium that would permit cross-fertilization of ideas. Even in their own specialty, such people will be less effective because they do not possess the educational background that would enable them to evaluate their own work against that of other professionals or, for that matter, against basic national interests and needs.

Here then is my indictment of American education: Its scholastic achievements are mediocre. Its pace is so slow that our children fall behind young Europeans almost from their first day at school. It does not produce the educated people we must have.

THE PRESENT NATIONAL CRISIS

In the past this could be tolerated for, protected by two friendly oceans, we could live as we pleased in splendid isolation. Our wealth in land and resources made up in part for our educational deficiencies. But the favorable ratio of land to population which until recently gave us *unique* advantages is now contracting. Wasteful habits, notably the whole idea of "planned obsolescence," are rapidly exhausting our nonrenewable resources while population grows apace—at almost three times the European growth rate. I estimate the day is but a generation ahead when we will no longer have *any* advantage over Russia or a united Europe as far as the material foundations of our society are concerned. Against this inexorable shrinking of special advantages in geographic isolation and natural wealth, the crisis in American education stands forth in all its gravity. The trouble we have holding our own *intellectually* against rival world powers presents a "clear and present danger" to the United States. Newspaper columnist J.A. Livingston, during last year's Berlin crisis, asked the pertinent question: "Were our horizons in diplomacy, space and propaganda limited by our way of life?" I would like to add, "or by our education?"

This state of affairs has concerned me for a long time. I have devoted much effort familiarizing myself with the problem and I have frequently spoken out for educational reform. Many "professional" educators accuse me of meddling in matters that are none of my business. But to my way of thinking every *national* problem is also the *private* problem of *every* American citizen. I think there can be no greater gift than to live in the United States—to live in our politically free society. But this is a gift not to be enjoyed passively. It comes at the cost of personal involvement with the fate of the Nation. To withdraw into one's private world and leave national problems to be solved by "others" is to me about as despicable as for an able-bodied person to evade his military obligations or to refuse to earn his living and sponge on relatives or on society. It is pure parasitism. The Greeks called citizens who took no interest in public affairs but were concerned only with themselves—with their ids—*idiotes,* from which the modern word idiot derives.

THE DEPENDENCE OF FREE SOCIETIES UPON LAY CRITICISM

Free societies depend on lay criticism. No public agency, no public official is or can be exempt from being scrutinized and criticized by the people. Certainly not the schools which are institutions financed by the people's taxes. The official attitude of the American education establishment is that no one who is not part of the establishment can make a valid criticism of the schools. There is a standard procedure for dealing with critics. They are declared to be ill-intentioned troublemakers and ax grinders, ignorant, uninformed, et cetera. There is no need to reply to their case against the schools except to repeat these deprecations of the critic as a person. This party line reveals on the part of the people to whom we entrust the education of our children a truly appalling misunderstanding of the working of the democratic process.

Criticism by individuals is a vital part of the democratic process. Public action in a democracy comes in response to public demand. Before the people can demand remedial action, they must first discover existence of defects in the status quo. When the defects exist in powerful public agencies the impetus for reform necessarily must come from outside. Such agencies rarely generate self-reform; their hierarchic organization effectively prevents this. Hence democracies depend on individual criticism. This is the reason why freedom of speech and a free press are important. It is through them that the public is made aware of problems that must be remedied. Otherwise, public agencies would be able forever to hide the truth from the American people by setting up a screen fashioned of slogans, cliches, and illusions designed to project a favorable image of the agency and to bury its shortcomings. This sort of thing has become a fine art with public relations staffs.

When the function of the critic is thus hampered by personalizing public issues that ought to be debated on their merit, then democracy itself is weakened. No wonder our schools have so little success in educating American youth for democratic citizenship, in transmitting to young people a deep sense of civic responsibility, a clear understanding of how democratic government works and what is the role of the citizen in a democracy. How can it be otherwise when the democratic process is so little understood by the people who manage our school system.

Now that the American public has awakened to the educational cold war into which we have been drawn, the schools, in fact, have had to submit to much scrutiny and criticism. Recently a booklet prepared for the National Education Association noted that much greater pressure is being exerted on our schools to institute a more rigorous instructional program. Next to Sputnik, the school administrators listed "outside critics" as the "most influential source of this demand."

THE NEED FOR A MORE PROFESSIONAL ATTITUDE TOWARD EDUCATION

To speak against our educational system is not easy, but not to speak at all requires only silence. If I add my voice it is because I think that perhaps I can contribute in a small way by what I might call my "professional" attitude toward education. Professional people are trained to look at a problem as unemotionally as possible. They try to get at fundamentals. They try to separate the essential from the nonessential. In education this means locating the principal task of the school and concentrating on how the school performs this task. If it performs badly, as measured against what society demands of the schools or against what the country must obtain to remain educationally competitive, then the school must be pronounced a failure. And the fact that it may do other tasks well or may make children happy is irrelevant and offers it no alibi.

A SCHOOL'S TECHNICAL TASK

Mr. Cannon. Admiral Rickover, you say you look at American education "as a professional," that you are therefore concerned only with the manner in which schools do what you call their "technical" task. Just what is meant by that?

Admiral Rickover. I think anyone looking at the schools in a professional way would analyze our educational problem as failure of the schools to do their *technical* task properly. I use the word "technical" which is not a good word but I can't think of a better one. What I want to express is that the school's proper job is something that can be judged *on its merit* and without reference to the *place* where the school is located.

This technical job, as I conceive it, consists almost in its entirety of helping every school child make the best possible use of his God-given intelligence. The school's major objective should be to send its graduates into the world equipped with the knowledge they will need to live successfully, hence happily. And with as well trained a critical intelligence as can be developed, given their innate talents, their motivation, and the time allowed the school to accomplish this difficult task.

THE VALUE OF EXAMINING "TECHNIQUES" OF OTHER SCHOOL SYSTEMS

Now in all countries the schools are expected to, and do, other things as well. Some of these things we do not like. We don't like the way that Russian schools try to shape young children into what they call "Soviet Man." We don't like the way some private schools abroad deliberately try to shape children into a type they consider ideal as "leader." When I say we should concentrate on the technical task I mean we should disregard these other school activities. Just because we don't want our children to be shaped into replicas of "Soviet Man" is no reason we shouldn't look into the way Russian schools manage to transmit twice as large vocabularies to sixth graders than our schools, or to teach them so much more mathematics, science and languages.

When another school system does a better technical job, it is irrelevant to counter that we enroll more children and that they stay more years in school. Quantity is not a substitute for quality. What I am interested in is the *techniques* that are used in good school systems. Most professionals take this view because it is the mark of a professional person that he is ready to borrow techniques developed elsewhere. His thinking is not confused by personal likes or dislikes of the people who develop or practice good techniques.

Take police work. The essential task of all police departments is to protect society against criminals. Nations have different ideas how policemen should conduct themselves toward the public and toward persons accused of crime. But when it comes to the *technical* task of detecting criminals, the police of all countries are only too ready to learn from one another. In consequence, modern techniques such as fingerprinting, blood tests, the whole scientific apparatus used in crime detection, are virtually the same the world over. There is even an international organization, Interpol, through which the police of different nations aid one another in catching criminals.

Or take medicine. Today there exists a gulf in the attitude toward payment for medical care between our country and Europe, including England. Abroad a consensus was reached some time ago that the cost of essential medical care—like the cost of education—should be socialized. In our country no such consensus exists. But though he may dislike socialized medicine, no American physician would hesitate to make use of a successful new surgical technique or drug therapy merely because it had been developed in England's or Sweden's socialized medical service. This is a *technical* matter, and he judges it on merit. You find the same professional attitude among artists and musicians. Dislike for Soviet communism would never prevent an American orchestra from reacting enthusiastically toward a Soviet soloist or conductor if these were first-rate musicians. *The only people I know who call themselves professionals yet who entirely reject what their counterparts abroad are doing are our educators.* To them European education is anathema, not on *technical* grounds but because school systems abroad do not pursue the *social or political objectives which our educators appear to consider more important than the technical task of developing the mental capacities of pupils.*

EARLIER AMERICAN BORROWING OF EUROPEAN TECHNIQUES

It was not always so. All through the 19th century we were part of the great educational world of the West. In early reports of the U.S. Office of Education you will find educational news from abroad intermingled with domestic news. American educators and educated laymen were fully aware of the merits and deficiencies of American education as compared to that of Europe. Our schools concentrated on the same intellectual task as the schools abroad. Scholastically they were not as good but on the other hand more of them offered tuition-free education. The European Continent had pioneered the concept of public or tax-supported education *at all levels*, and of free *elementary* schooling for *all* children up to age 14 or, as required by the Prussian school regulations of *1763*, from the fifth year "until the child is found to possess the knowledge necessary for every rational being," this minimum of education being compulsory. Our great contribution to education was the ideal that *all* fees, not only elementary school fees, should be abolished. From the United States this splendid ideal moved to Europe where it is now not only well established, but in some ways better realized.

The interchange of educational ideas was thus not a one-way proposition, but being newcomers in education we naturally borrowed more. The Puritans brought with them the parish school which at the time was the "common" school of Protestant Europe; this is the origin of the New England township school. They brought the English liberal arts college and the English grammar school that prepared children for entrance into college and into the higher echelons of government and industry. Later we borrowed from Prussia the teacher seminary, the kindergarten, and the graduate university. Free universal compulsory education was also continental, chiefly German, in origin.

THE REPLACING OF TRADITIONAL METHODS BY THE DEWEY-KILPATRICK THEORY OF EDUCATION

But when the Dewey-Kilpatrick theory of progressive education replaced traditional educational theories and practices in this country, we turned our back on Europe and withdrew into educational isolation. So isolated are we today that children of Americans living abroad can seldom be fitted into their proper age group in European school systems and European exchange students coming to this country can get no credit at home for their American high school year. By rejecting traditional school objectives, by making of the school primarily an agency for social leveling, by assuming, in the name of "whole" child schooling, responsibilities normally reserved to the family, the progressives have created an artificial gulf between American and European education, to our detriment. They take the parochial view that nothing can be learned from schools abroad, even though Europe has had seven centuries of experience with formal education and commonsense would indicate she might therefore have developed *some* techniques we might find useful.

In all the comparisons with other school systems I have made, I concentrate on the intellectual content of schooling here and abroad; all my comparisons have been scholastic. When it comes to giving children a marvelous time in beautiful surroundings where they can spend the years before they start to work in a pleasant way, finding mates, making friends and business connections, attending athletic spectacles, and also absorbing a little learning, then nobody can beat American education. I only fear that, delightful as this may seem at the time, it does not prepare our children for the realities of life. Developing intellectual powers and developing youth with agreeable personalities are not interchangeable accomplishments. If a school system is good at developing the intellectual potential of students it does its proper task well. If it fails in this task, the fact that its graduates are pleasant-spoken, nicely group-adjusted young people does not constitute a mitigating factor; the school system is still a failure.

TECHNICAL TASK DONE BETTER IN SCHOOLS OF ADVANCED EUROPEAN COUNTRIES

Mr. CANNON. Admiral Rickover, I do not believe America would be safe today but for what you have accomplished in the development of nuclear propulsion. It is extraordinary for a man of your distinction and achievement to leave your narrow professional field and tell us, in this great country, which we naturally consider to be the greatest and most enlightened on the face of the earth, that other nations have a better school system. So, with your permission, I shall ask you directly: Is it your contention, Admiral Rickover, that European schools do this technical task better? You say you look at American education as a professional, seeking to locate what is the school's technical task. Is it your contention that European schools do this technical task better than we do?

Admiral RICKOVER. In my opinion most advanced European countries now have public school systems that do a better *technical* job than our schools. As I said before, I confine myself to the technical task which ought to be judged on its merits and without reference to the cultural, economic, or political setting in which schools operate. I suggest we try to divest ourselves of the natural chauvinism everyone has about an institution so intimately a part of the national culture as the school. And that we even try to overcome the deep-seated conviction we all have that our children are unique, something quite special. Believe me, when it comes to getting the knowledge they will need into their resistant little heads, they are quite like children the world over. And as to what kind of knowledge they must be induced to absorb, this too, in large part, is the same in all modern industrial nations, especially in all modern democracies.

We are no longer a pioneer country with a vast wilderness to be brought under cultivation; where consequently average men without much education were urgently needed and amply rewarded and where "book learning" wasn't a requisite for success. We are now 70 percent urban and highly industrialized. Life here does not differ much from life in other advanced industrial democracies. Our children need as much formal education to become useful and happy members of society as they need abroad. American families are willing and able to assume the responsibilities Europeans accept for the moral education of their children, for their manners, their social life, their leisure-time activities. American schools—like schools abroad—can and should therefore accept their role as *supplementary* to, not *replacing* that of the family.

THE PROPER FUNCTION OF A SCHOOL IN A MODERN INDUSTRIAL DEMOCRACY

In my opinion our "professional" educators have a wrong idea of what is the proper function of a school in a modern industrial country that is also a democracy. When they engage in "whole" child education they invade the domain of home, church, and community. Besides there just isn't time for the schools themselves to do the whole education job. What the child learns at school can never be more than a *part* of his education. As I see it, education in the broadest sense of the term means *educing* or bringing forth a child's innate potentialities; it means adult guidance of his growth toward spiritual, moral, physical, and intellectual maturity. Education, for most of man's history on earth, and even today in many parts of the earth, has been almost wholly an informal kind of apprenticeship with virtually the entire responsibility resting with the family. It is only when societies reach high cultural and technical levels that the untrained parent must relinquish part of the education job—that of training the intellect—to professional experts. A school system performs its proper task when it does a first-rate job of equipping children with the requisite knowledge and intellectual skill for successful living in a complex modern society.

It is civilization that makes school a necessity for the continuance of social life. In simpler eras learning was in a sense a luxury, but today learning is so essential that all advanced countries have tax-supported public school systems. I think it is important we keep in mind that the effort children must make to improve their minds and fill them with even larger amounts of systematic knowledge, the expense to which parents and society must go in order to obtain professionally competent teachers and to build and equip modern schools—that all this is the price civilization exacts from us. In simpler societies, in preindustrial, self-sufficient, and isolated communities—such as pioneer America—a child did not need much formal instruction to become a successful man or woman and a useful citizen. Parents, relatives, friends, though quite untrained as teachers, were able to, and usually did do the whole job of educating. A large part of education still takes place in the home where the ratio of instructor to learner is much the most favorable: sometimes one parent to one child, a close approximation to the log with Mark Hopkins on one end and the student at the other.

EUROPEAN SCHOOLS CONCENTRATE ON DEVELOPING A STUDENT'S MENTAL ABILITIES

European schools do their *technical* job better than our schools because they make it the pivot of their efforts. It is true that besides intellectual training, the schools abroad, as those here, have been entrusted with certain responsibilities that are not "intellectual" in nature. All good schools try to awaken their pupils' esthetic, artistic, and musical sensibilities since these can so greatly enrich an individual's life. Art and music are to be found in virtually all curricula. All goods schools give attention to their pupils' bodily health through physical education, games, and sports. There usually are also regular medical and dental checkups and often provision is made for serving inexpensive lunches. Apart from these responsibilities, European schools concentrate on developing their student's *mental* abilities. Even when they provide courses in manual subjects, they teach them in a manner that will awaken the unacademic child's interest in academic subjects through his experience with mechanical work. In England, for instance, deliberate efforts are made to use commercial courses to guide children into an appreciation of the importance of English, shop courses to demonstrate the importance of mathematics and science, household courses for the girls to awaken interest in chemistry.

There is general agreement abroad that a school must accomplish three difficult tasks: *First*, it must transmit to the pupil a substantial body of knowledge; *second*, it must develop in him the necessary intellectual skill to apply this knowledge to the problems he will encounter in adult life; and *third*, it must inculcate in him the habit of judging issues on the basis of verified fact and logical reasoning. In carrying out this assignment good teachers are often able to transmit, as if by osmosis, such other desirable attitudes and habits as conscientiousness and stick-to-itiveness, intellectual honesty, friendliness toward classmates, a pleasant way of speaking, polite manners. These are extra dividends in a good school. But they can never take the place of its principal task which is to develop the mind.

To perform these difficult assignments, schools need every minute of the time they have the child in their care. In this country they only have him during one-sixth of his waking hours, the same length of time average children spend in front of the TV set! To perform these three tasks schools also need intelligent, professionally trained teachers who have mastered their subjects and who have teaching skill. European teachers at all levels of schooling are better educated and better trained for their profession than our teachers.

AMERICAN REFORM IN THESE AREAS URGENTLY NEEDED

That European schools do the *technical* task better is only natural, given the fact that they devote the lion's share of the curriculum to basic education and have the teachers with requisite intellectual and educational qualifications. In contrast, our schools dissipate their energies on marginally useful courses, on life-adjustment training, on stuff that can be done by the family or by other agencies, while neglecting the *one* thing that *no other* agency can do. The one thing *only* the school can do, and that is to enhance mental capacity by providing a challenging course of studies. Far too many of our teachers do not possess the intellectual and educational qualifications that would permit them to offer such a course of studies. There is an easy way out, and many of our schools are using it. They teach simpler things that are easy to teach, easy to learn, and more fun besides—how to be lovable, likable, and datable, how to be a good consumer, etc. These aren't subjects you can grade, the way you can grade mathematics or science or languages, but they are good for hiding the ignorance of both teacher and pupil. And because this sort of thing goes on, our schools fail to perform their technical task. This is why reform is urgently needed.

SCHOOL REFORM A RECURRING NEED

School reform is nothing new or unusual. At one time or another almost every country has found its schools no longer functioning in accord with the needs of changing times. Schools have to be continuously examined to make certain they stick to their assigned role among the country's various agencies for social improvement and progress. Of course, reform is always painful to those whose habitual ways will be upset. In no country has it been accomplished without travail. And the educational establishment of almost every country has fought against reform.

IMPETUS TO SCHOOL REFORM FROM OUTSIDE THE PROFESSION

If you look into this matter you will find that the impetus leading to school reform nearly always came from persons outside the educational hierarchy. The long battle for reform of England's ancient endowed schools and universities in the 19th century found most of the educators ranged on the side of the status quo. The reformers were men of the most varied kind. They were novelists and poets, physicians and scientists, persons of independent means and others who could spare for this labor only the time left them after earning a living. There were few educators. Those engaged in teaching had a vested interest in the status quo, for in it they had an assured place; just as in this country not many public school educators are actively promoting reform, and these few in most cases only jumped on the bandwagon after lay critics had aroused public indignation at the schools.

Most American educators still refuse to acknowledge that our school system is scholastically deficient, even though its deficiencies are now being documented in detail by many serious and well-informed critics. The "party line," adopted in the 1940's, still is that critics are maladjusted persons—"ax grinders"—taking out their frustrations on the schools, or that they all are part of a sinister conspiracy engaged in a calculated and far-reaching plot to destroy the public school system; or that they are irresponsible calamity howlers and so on *ad nauseum.* The educators still claim we have the world's oldest—if not the only—system of universal primary education; that any "unbiased critic" must acknowledge American education to be "strikingly good;" that we have 25 percent of our youth in "higher" education against 5 percent of European youth. These are glaring misstatements based on a gamut of illusions about our schools that have been so assiduously promoted and for such a long time that many Americans have come to believe them implicitly.

PRESENT REFORM DELAYED BY LACK OF PUBLIC AWARENESS

Reform is being held up because the public does not fully realize how badly we need to improve scholastic standards in order to be educationally competitive. Most Americans are not aware of the extent and seriousness of our school dropout problem which makes a mockery of the boast that we educate *all* our children. Particularly unfortunate is our habit of equating our colleges with European universities when in fact, as compared with Europe, most of our colleges are vocational or secondary schools and even our best liberal arts colleges attain university levels only in the "major" the student takes in his last 2 college years. Chapter IV of my recent book, "Swiss Schools and Ours: Why Theirs Are Better," deals exhaustively with this particular illusion. May I ask that it be included in the record.

Mr. CANNON. It will be included in the record.

(The matter referred to follows:)

CHAPTER IV. THE CONTINENTAL UNIVERSITY—SWISS SCHOOLS AND OURS: WHY THEIRS ARE BETTER

H. G. Rickover (copyright 1962 by the Council for Basic Education)

Despite Europe's political fragmentation, one can speak of *the* continental university as an institution common to all advanced nations. Whatever may be its date or place of foundation it will be within a broadly uniform pattern; not the same today as it was in the 12th or 13th century,[1] and, of course, with some national disparities. But the relationship between a modern continental university [2] and the *studium generale* from which it has evolved is readily discernible. It still is, as it has always been, an association of scholars who seek and teach the highest truth—learning that is universal, not particular to any one country.[3] The degrees awarded by universities of different continental nations remain to this day roughly equivalent and show a recognizable relationship to those issued under medieval charters; these were themselves equivalent because, out of a desire to obtain the *jus ubique docendi,* the right to teach anywhere in Christendom, the universities almost from the beginning sought to secure charters from one of the two universal sovereigns, Pope or emperor. This meant they had to accept uniform regulation of their degrees. Down through eight centuries the tradition has never quite died out to look to a professor's scholarship rather than his origin when sending out "calls" to fill a vacancy. Neither has the custom of medieval students to "wander" across Europe from university to university. Now most of their wandering takes place within their own country, but not a few stray across political boundaries for a semester or two at a foreign university to attend lectures by some particularly good man in their field. The linguistic proficiencies of continental students and the basic similarity of continental universities facilitate this intellectually fruitful habit.

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[1] These were the centuries when the university took form and began to spread northward from Italy, but Salerno and Pavia had universities in the 9th, Bologna and Paris in the 11th century.

[2] The term "university" came into use in the 14th century.

[3] The university was originally and for a long time called a *studium generale,* to distinguish it from local institutions, called *studium particulare.*

The university established itself, set up its goals and standards, and developed its basic structure and procedures at a time when the Continent was spiritually and intellectually unified and all education was in the hands of a single church; even politically, much of the Continent was then loosely joined in the Holy Roman Empire. The memory of Europe's unity under Rome lived on through the Middle Ages, to be buried only after Reformation and Renaissance broke the Continent into three warring religions (Catholic, Lutheran, Calvinist) and a host of newly independent states. But the Middle Ages have bequeathed to the present an ideal of unity at the summit of man's intellectual potential, a readiness to emulate excellence as such, without reference to the nation where it comes into being. This reinforces the sense of solidarity common to scholars and serves to hold the universities of disunited, often mutually antagonistic, continental nations to a roughly identical pattern.[4]

Recognition that at the highest level learning ceases to be parochial or national has been a constant throughout the long history of the continental university. Since modern continental school systems are integrated with and oriented toward the university, teachers abroad tend to be less given to the kind of educational chauvinism that impels uninformed schoolmen in this country to make tactless and intemperate remarks about foreign schools, such as calling European education élitist, archaic, fossilized rote learning. But then we are, educationally speaking, extremely young compared to the Continent. We lack its long tradition of intellectual unity and respect for learning.

We need to be better informed about higher education abroad. The widespread notion that continental universities are and have always been institutions attended only by upper class youth is at variance with historical fact, as will presently be seen. We are hopelessly confused about the concept of exclusiveness. The continental university is and always has been exclusive in the sense that it shuts out the incompetent. This is an inevitable consequence of the specific task this institution performs. It is task-centered, truth-centered, and this automatically limits admission to people of a given intellectual caliber. The continental university is a specialized educational institution doing an important and difficult task that is today and has for hundreds of years been highly respected abroad. Witness the medieval saying: Three nations are more fortunate than all others; the Germans because they have the emperor, the Italians because they have the Pope, the French because they have the University of Paris.

We are wont to look somewhat disdainfully on the Middle Ages as a period of ignorance and superstition, lacking the amenities we consider essential to civilized life. Yet that "benighted" age had a quixotic veneration for learning wholly at variance with our own sophisticated antieggheadism. It was then naively believed that knowledge was well worth the long and painful effort its acquisition entailed; that it gained a man not only personal happiness but "status" as well. The papal charter of the University of Basle (founded 1459) speaks of the hard and persistent labor by which students may obtain what is called—in the high-flown language of medieval pronunciamentos—"the pearl or jewel of scientific knowledge (*scientiae margaritam*)" and with it "one of the greatest happinesses accorded mortal man by the grace of God." This pearl is the key to a good and happy life, it "bestows its favors on the untaught and raises to the heights men born in the lowliest circumstances," for "as learned men they are placed far above all who are unlearned, indeed made alike to God (*deo similem reddit*)."

This is an intellectual "élite" concept we seem unable to grasp, since for us the word "élite" conjures up nothing but false claims to superiority based upon the accident of birth. Yet through the greater part of its history the continental university was not "fashionable" in the social sense. Medieval professors and students certainly were more often poor than well to do. Scholars were for the most part in clerical orders[5] and were usually expected to live communally in bare, unheated dormitories.[6]

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[4] Excellence wherever it appears tends to be emulated; national likes and dislikes carry surprisingly little weight. The University of Paris copied Italian models: Heidelberg humbly stated in its charter (1386) that it would seek to copy Paris; during the Renaissance northern Europe copied Italian university practices: in the 19th century the whole Continent modeled its universities after that of Berlin (1809). Yet Germans never liked Frenchmen much, northern Europeans did not admire Italians, the Scandinavians and Swiss had no love for Prussia.

[5] Until 1854 Oxford and Cambridge dons were required to be in [Anglican] orders.

[6] On the Continent, university residence halls disappeared when lay students began to grow in numbers; young gentlemen had no taste for life in such monastic environments. That the residential college survives in England to this day may be due to the fact that it was far more generously endowed than continental dormitories and thus could provide a style of life acceptable to young English gentlemen. It is interesting to note that one of the reasons higher education is so much more expensive in our country than on the Continent is that our universities have followed the English example and are usually residential. We tend to think of this residential feature as an essential part of higher education but it is merely a remnant from the monastic past of the university.

The medieval university had something of the aspect of a "learned" monastery. It was usually built with money given by well-to-do persons as pious deathbed bequests; tithes helped support clerical scholars, just as they defrayed the cost of monasteries and church services in general. The number of students was of course very small compared to modern times. This was inevitable, for only machine production makes it possible to support large numbers of young people in the classroom. Preindustrial Europe could not have financed a mass education system; it then took the labor of some 10 peasants to feed 1 "unproductive" person. But to conclude from this fact that the university was "aristocratic" misreads medieval conditions. The life of scholars was one of intellectual but not of social or financial privilege. University men constituted an élite, not of class but of merit.

When the Reformation ended the monopoly of the church as universal educator and the newly independent states took over responsibility for public education, they discovered it was difficult to induce the sons of well-to-do families to undertake the long studies required of "learned" professionals. Yet by then statecraft had advanced to a point where increasingly such university trained men were needed for positions in the higher civil service and as lawyers, doctors, and theologians. Oddly, at that time it was theologians who were at a premium. The 16th and 17th centuries were a time of constant religious war, waxing now hot, now cold, with virtually every one of the hundreds of new small states drawn into the conflict. Princes needed learned theologians to provide them with an intellectual defense of the established state religion. Good theologians were a major national asset, rather as scientists are coming to be in our age of continuous technological war and for similar reasons.

To obtain enough professionals, the new states had to underwrite the education of talented poor boys. Many princes used confiscated church property to maintain residential university preparatory schools where all or most students were on full scholarship (in return for a promise to enter the service of the state).[7] It was an age of mercantilism when each state tried to be as self-sufficient educationally as it tried to be economically; when human talent was hoarded just as were gold and silver bullion.[8] In Protestant states, reasons of state were reinforced by religious imperatives, combining to spark the first complete public school systems.[9] For a good Protestant it was almost sinful to be illiterate, since Bible reading was so important a part of his faith. From this time dates the custom of charging ministers with the duty to teach in elementary schools. By an ordinance of its suzerain Berne (1532), Protestant clergymen in the canton Vaud were required to instruct village children so that they might be able to read the Scriptures; a law of 1628 made attendance at school obligatory. It has been said that "the Reformation was the cradle of popular or mass education."[10] Luther and Melanchthon constantly urged the Protestant princes to establish free and compulsory elementary schooling.

Of great importance to the development of the continental university was the appearance of a new kind of school, designed to meet the needs of States too small or too poor to support full universities, yet anxious to train needed professionals within their own borders. It evolved out of the medieval Latin school to which were added some courses normally given at the medieval university. This new type of school was called *Gymnasium illustre*, or *Academicum*, or *Collegium humanitatis*. Some of these schools became famous—notably Sturm's Strasbourg school—and eventually were transformed into universities.[11] But what was more important, they were forerunners of the modern continental maturity school, which grants the bachelor's or maturity diploma and leads directly into graduate professional university studies.

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[7] An interesting sidelight on the talent search then going on is given by the Braunschweig-Wolfenbüttel school law of 1651 which expressly required village schoolteachers to be on the lookout for bright boys and to teach them Latin so they would be prepared to enter the free university preparatory schools. On the Continent (in contrast to England) scholarship students who were poor did not lose out against the influx of middle- and upper-class students until the 18th century; it was the status accorded the upper echelons of civil servants in monarchies that upgraded the universities. Maturity schools, however, retained scholarships often running to 10 percent of places; most of the pupils there came from middle-class families.

[8] States tried to keep their professionals from emigrating as they tried to keep their money from flowing off through high imports; some forbade studies at foreign universities. These mercantilist practices were swept away by the ideas of the French Revolution, but they had served a good purpose in getting school systems started. Occasionally such school systems yielded an unexpected dividend, as when they rescued a genius like Kepler from an extraordinarily unfavorable home background and gave him a free education. Given his unprepossessing personality and many handicaps, a modern Kepler might well not have as good an opportunity to realize his potentialities if he were born in some educationally backward region of our own country. One wonders also whether he would get by the screening process set up by our better colleges (personality, extracurricular activities, etc.).

[9] Followed in short order by various Catholic states.

[10] By Francois Guex in describing school development in the canton of Vaud. See his *Histoire de l'instruction et de l'éducation* (Lausanne, Paris, 1908), pp. 5, 61, 657. In 1537 a Latin school and academy were established; Vaud thus had one of the first complete school systems.

[11] Besides Strasbourg, Berne, Lausanne, Zürich, etc.

Thus it was the educational activities of the newly independent states that provided the university with solid educational underpinnings and so made it possible to alter its educational responsibilities. The evolution of the continental university has been toward more precise delimitation of its specific tasks. In the Middle Ages only the university held to a standard. Preparatory schools reflected local diversities and were often so mediocre that students arrived at the university without firm command of Latin and of the elements of learning. It was this local failure that compelled the university to concern itself with preparatory schooling. Many universities established for this purpose a so-called *pedagogium;* it was also not uncommon for university professors to undertake (for a fee) the task of educating would-be students almost from scratch, just as many American colleges now are giving remedial instruction in English and arithmetic—elementary subjects which Europeans normally master before they reach their teens. Inadequate university preparation belongs to a stage in the evolution of continental education that has there been passed more than a century ago.

The new state-supported school systems eventually brought fixed standards for university-preparatory schools. Here Prussia led the way. The first regulation of *Gymnasium* or maturity examinations was the Prussian law of 1788. Toward the end of the 18th century a movement was underway to reorganize the educational division between university and university-preparatory school. It was Prussia's total defeat by Napoleon and the loss of the western half of the country with Prussia's best university (Halle) that gave impetus to long-proposed reform plans.

School reform was part of a remarkable program that was to rejuvenate this creaky feudal state and usher it into the new century of science and technology, armed with a system of education that proved its worth almost from the start and won Prussia many decades of undisputed intellectual leadership on the continent. Reorganization of university and university-preparatory education, in particular, set a new pattern of higher education for the entire continent. Though there are, of course, variations in detail in the several states, what is common to them all is that within higher or academic education they make a clear-cut distinction between what is properly termed general or liberal education, in contrast to "specialized" or professional education. Only the latter is now acquired at the university; previously both were obtained there. In the pre-19th century continental university, general education was the task of the faculty of arts or philosophy. Professional education was the task of the three graduate faculties of theology, law, and medicine. All students had to take the liberal arts course of the philosophical faculty [12] and to obtain there the first (inferior) academic degree, the *baccalaureus in artibus*, which was required for admission to the graduate faculties where the higher degrees of master and doctor could be earned.

The Prussian reforms elevated the university in its entirety to the level of a graduate institution. At this level of specialized higher learning they enlarged the university's responsibilities by making it both a teaching and a research institution. The first university conforming to the new pattern was Berlin (founded 1809). It soon became the model throughout the continent. To summarize: the modern continental university differs from its predecessor in having been given one new task (scientific research) while being relieved of one old task (undergraduate teaching).

Of course, research had also been done in the medieval, still more in the Renaissance, university but this was for the most part a relearning of what the great minds of Greece and Rome had already discovered. Something more was envisaged by the Prussian reforms when they made research part of the university's assigned task. Europe had by then caught up intellectually with classical civilization and was ready to undertake independent exploration beyond the frontiers of existing knowledge. During the 19th century, the modernized continental universities achieved their most spectacular successes in this new kind of research.[13] They could now do better research for having been relieved of undergraduate teaching.

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[12] Friedrich Paulsen said of the prereform faculty of philosophy that "its task used to be the general scientific preparation for special professional study in one of the so-called upper faculties." *The German Universities* (London, New York, 1895) p. 77.

Much of their research centered in the reconstituted, now fully graduate philosophical faculty. This faculty rose from the lowest (also lowest-paid) position in the university to outshine the older professional faculties. Its function came to be chiefly that of a graduate faculty encompassing all academic disciplines other than those which could logically be subsumed under the faculties of theology, law, and medicine. Because of its catholicity of content, the philosophical faculty also attracts students who may take time off from their professional studies to attend a course or two in some subject of special interest to them; thus it continues to contribute to the student's "general" education but now at the graduate level and on an elective basis.

Today the philosophical faculty is the very core of the continental university where most of the basic research is done and most of the doctorates are awarded—doctorates in such widely differing areas as mathematics and archeology, chemistry, and history. For some "learned" professions of a technical character, specialized university-rank institutions are usually set up on the Continent—such as the Zürich Institute of Technology, graduate schools of economics and commerce, of architecture, and the like. These specialized institutions concentrate on a single discipline or group of disciplines and might be regarded as incomplete philosophical faculties dealing with technology.[14] Here the model has been France's famous *Ecole Polytechnique*, founded in 1794–95.

Elevation of the university in all its departments to graduate level necessitated extension and upgrading of the university-preparatory school. The continental pattern of education assigns to a particular kind of secondary school—the academic or maturity school [15]—the future university student's general education and preprofessional preparation. Studies formerly pursued in the faculty of philosophy now make up the program of the top three grades [16] of this school. This is the geninely "academic" part of the maturity school, the most difficult part which many students find beyond their capacity. Hence there is a big dropout before the start of the last 3 years.

When it is remembered that university studies used to begin at an earlier age than now, the change from philosophical faculty to maturity school is not as drastic as might appear at first sight. In Basle, for instance, boys used to attend Latin school from ages 8 to 14, the faculty of philosophy of the university from 15 to 18, ending their general education with a *baccalauréat* entitling them to begin graduate studies. Since Basle University changed (in 1817) to the pattern established by the new university of Berlin (1809), students received their maturity diploma from a *Gymnasium* at age 18 and are thereupon admitted to the university where *all* courses now are graduate. The fact that on the Continent it takes but 12 to 13 years to obtain a good liberal education, while here it takes 16, is to be explained by the quality of maturity-school students and teachers and the greater effort devoted to learning, as well as better sequential planning of the curriculum.[17] Teachers in these schools will have studied 3 to 4 years at a university, students will have intelligence well above the average (approximately corresponding to that in a good American liberal arts college). They are schools for a talented minority, albeit a substantial one.[18]

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[13] To call it "new" is perhaps not entirely correct. The universities of Halle and Göttingen pioneered during the 18th century in what the Germans call *Wissenschaft*, a word for which we have no exact translation. Sir Eric Ashby defines it as "the objective and critical approach to all knowledge," which is certainly akin to what we call basic research. *Wissenschaft* was "the guiding star" of these universities even before the scientific revolution reached them. Through "objective analysis of the classics, questioning, comparing, searching the ancient literatures for historical truth wherever it might lead" these universities produced definitive classical, philological, and historical studies. "So the foundations of *Wissenschaft*—the empirical approach to knowledge—were laid in Germany not by scientists but by humanists, and they were laid in the universities." (*Technology and the Academics* [London, 1958], pp. 22–23.)

[14] To illustrate the difference: Industrial enterprises will have managers and engineers trained in an institute of technology, chemists and physicists who obtained their doctorates from a university faculty of philosophy. (Ashby, *op cit.*, p. 62.)

[15] The Germans appropriately call them *Gelehrtenschuler*, schools for scholars.

[16] It is these three grades that are missing from what we have termed the "incomplete maturity" school (see preceding chapter).

[17] Age of admission to maturity schools varies from 9 or 10 (Germany, Austria, some parts of Switzerland) to 12 (Holland, France, the greater part of Switzerland). Total length of preuniversity schooling is 12 to 13 years. At 18 to 19 the continental youth is ready to begin professional university studies; here such studies at a "good" university require a bachelor's degree, hence 16 years of preparation. For the amount of class instruction packed into the continental course of preuniversity education see *infra*, pp. 114–116.

It has been noted that doctorates awarded by continental universities are roughly equivalent; [19] so are maturity diplomas—the *Abitur* (Germany), *baccalaureat* (France), *arte* (Scandinavia), or *Maturität* (Switzerland). Holders of such diplomas are usually permitted to matriculate in any continental university without further formalities, exactly as holders of the medieval baccalaureates formerly were permitted to enroll in the higher faculties of any university.[20]

Another salient feature of the Prussian reforms found general acceptance and is now part of the continental pattern of higher education. This is the setting of nationwide scholastic standards (through a ministry of education or some other public authority) to which maturity schools and their teachers much conform. A beginning had been made in 1788 with the first Prussian maturity examination regulation. Raising of standards through legislative specifications took several decades. Prussia had at the beginning of the 19th century a plethora of inferior burgher schools claiming to be university-preparatory institutions,[21] as well as mediocre universities. The weakest of these were eliminated, some were downgraded (the burgher schools to "incomple-maturity" schools, for instance) and others were brought up to the new and tougher scholastic standards. The standards thus brought honesty in educational labeling and allowed for smooth articulation, since every school's task was now clearly delineated. University courses were affected indirectly since all professional diplomas now required the passing of a state examination.

Abroad, national standards are considered a protection for the student rather than unwarranted interference by the state,[22] especially since standards are drawn with infinite care and by men of solid scholarship and educational experience. Maturity diplomas and academic degrees have rough equivalence on the Continent because there is a consensus that educational institutions ought to be held to scholastic standards and degrees ought to represent definitive achievements. Higher education on the Continent is kept to fairly equal levels by virtue of the desire of peoples and governments to be competitive with their neighbors.

This unity in higher education stops at the channel. For reasons into which we cannot go here, England and the Continent parted ways educationally beginning with Tudor times; it was only toward the end of the 19th century that closer relations were reestablished. But during the long period of English educational isolation, her two ancient universities developed in the opposite direction from that taken by universities on the Continent. There the trend was toward strengthening and expanding professional (graduate) university education, while in England the universities became more and more purely undergraduate institutions. In the 15th and 16th centuries, Oxford and Cambridge lost two of their three professional faculties; legal education moved into the Inns of Court, medical into the Royal College of Surgeons.[23] While theology remained, the universities were increasingly eclipsed by their colleges. There, teaching was by nonspecialist tutors, not by professors who were scholars in their particular field (on the Continent the absolute requisite of a university); few academic degrees other than the baccalaureate were awarded; the colleges offered what across the channel was termed a "general" or liberal education.[24]

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[18] When American educationists accuse Europe of having a class system of education because only a minority attend full maturity schools, they conveniently overlook the existence (for centuries) of various types of "incomplete maturity" schools (*Progymnasia*, *Realschulen*, burgher schools) These provide secondary schooling the equivalent of, if not higher than, what is obtainable at average American high schools. For a detailed description of the vast network of Prussian schools existing a hundred years ago—when nothing comparable was to be found in our country—consult Matthew Arnold, *Higher Schools and Universities in Germany* (London, 1874). Subsequent references are to 1892 edition. Graduates of intermediate secondary schools complete their professional training at various kinds of semiprofessional institutions offering courses that in this country are to be found in vocational colleges (as, for example, teachers colleges, agricultural and business colleges, nurses' training institutes).

[19] Because of this rough equivalence, it is not customary on the continent to string out letters after one's name, indicating where one has received one's undergraduate education or doctorate (A.B. Yale, Ph. D. Columbia, etc.); people use the prefix "doctor" and leave it at that. It is taken for granted that a doctor has obtained an excellent general education and done the normal amount of intellectual work for his Ph. D. degree. Of course, while they do not vary much geographically, some doctorates represent a higher achievement because their particular subject is more difficult to master, or fewer people have the special aptitudes required. Thus doctorates in abstract fields (mathematics, physics, chemistry) are harder to earn (hence perhaps somewhat more highly regarded) than doctorates in the humanities or social sciences.

[20] An immense amount of money and of the time of university professors is saved by this rough equivalence of degrees abroad. Consider that in our country a high school diploma has so little value in the academic world that a privately managed examination (the college boards) is required by the better colleges, plus all sorts of detailed probings into the candidates' credentials. The cost of "processing" a student for admittance to a first-rate college runs to about $300. *Pari passu*, it should be noted that some of the questions asked by admissions offices, some of the considerations that influence decisions (personality, extra-curricular activiies, family background, geographic origin, etc.) are abroad considered intolerable invasions of privacy besides being wholly irrelevant to the question whether a young person has the necessary scholastic preparation and intellectual aptitude to do maturity school or university work. Students in the United States wishing to enroll in the better professional schools and graduate departments must again undergo a lengthy and costly sorting process because a B.A. or B.S. here has no fixed value.

[21] These were locally controlled. Their scholastic mediocrity was commonly laid to unintelligent meddling with the schools by uneducated city officials and parents.

[22] We need not ourselves accept this point of view but we ought at least to understand it. Poorer countries cannot afford the luxury of expensive public schools producing valueless diplomas and degrees. In order to give a good education to those who make the requisite effort, they must eliminate the loafer, the person who claims to have an "equal" right to the best in education without being able or willing to absorb it. It makes no sense to call this "undemocratic."

So few contacts existed with universities abroad that the English universities were largely unaware of the vast changes that had occurred in continental university education since the turn of the 19th century. Matthew Arnold—poet, school inspector, and persistent critic of English education—was one of the first to point out that 19th century Oxford and Cambridge were not universities in the continental sense but *hautes lycées*, a kind of luxury maturity school. He wrote "Though invaluable in their way as places where the youth of the upper class prolong to a very great age, and under some very admirable influences their school education * * * they are still, in fact, *schools*, and do not carry education beyond the stage of general and school education. The examination for the degree of bachelor of arts, which we place at the end of our 3 years' university course, is merely the *Abiturientenexamen* of Germany, the *épreuve du baccalauréat* of France, placed in both of these countries at the entrance to university studies instead of, as with us, at their close." [25]

Arnold wrote in 1874. Since then, English educational standards have risen enormously, many new universities have been established in the provinces, the number of grammar schools has greatly increased. Democratization of education, especially since the 1944 Education Act, has brought intense competition for university and grammar-school places. This has given educational standards a mighty push upward. Most students now take "honors" degrees, many pass the highest and toughest kind of general education certificate examination (scholarship level). These students will have covered as much as is acquired in the first year of an English college. Comparison with continental maturity-school graduates is difficult since English students from age 16 on concentrate intensely on one or two (rarely three) subjects,[26] while continentals pursue a generalized liberal education through their entire preuniversity course of schooling. Oxford scholar A. D. C. Peterson, in a recent study, estimates that, roughly speaking, the continental maturity represents a standard of academic attainment that is reached by the average English student at the end of his second year at college.[27] This would be natural, since the English school week and year are shorter by about that much than the continental. The rise in the level of achievement at the end of grammar school has had the natural result that English colleges are now becoming universities in the continental sense.[28] Educationally, the channel—so narrow in the Middle Ages, so wide from the 15th to the 19th century—is shrinking. Not so the Atlantic.

We inherited the college from England and proceeded forthwith to prolong it from 3 to 4 years. Lacking standards, our colleges were left free to be as mediocre as they chose. As long ago as 1890, before educational progressivism and egalitarianism had begun to water down the content of the average American college education, James Bryce remarked on the great number of inferior colleges here and the variability of our college degrees. Of our bachelor's degree, he wrote that its value was slight and uncertain, many having "no assignable value, except that of indicating that a youth has been made to work during 4 years at subjects above the elementary level." [29] So greatly do American degrees differ in educational content that what is said about the "average" American bachelor's degree will not do justice to our best, nor reflect the much lower standards of our worst, colleges; no comparable degree of variation is to be found on the Continent. A. D. C. Peterson's evaluation of the average American B.A. agrees with conclusions previously reached by Americans thoroughly conversant with education abroad. He says that "roughly speaking, if we take the bachelor's degree as being of a certain average standard of academic attainment, it is true to say that this was, and is, reached in Germany and France [30] at the beginning of the university career; in England at the end of the second year * * * and in America at the end of the fourth." People familiar only with English and American universities, he points out, find it difficult to understand the continental university "until they realize that by our standards it [does] not cater to undergraduates at all, and that all the students [are] studying either for final professional examinations or for a doctor's degree." [31] Swiss universities normally accept without further formalities students possessing maturity diplomas from other continental countries; they rarely accept Americans unless they have a bachelor's degree.[32]

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[23] A. M. Carr-Saunders and P. A. Wilson, *The Professions* (Oxford, 1933) pp. 289-299.

[24] Ashby, *op. cit.*, pp. 6–12.

[25] Arnold, *op. cit.*, pp. 209–210, 219. Not only were English universities overwhelmingly "undergraduate," hence comparable not to continental universities but to maturity schools, there were far fewer of them as well. After the University of London was founded in 1836, and Prussia had abolished all its mediocre universities, she still possessed eight to England's three, yet the two countries had about the same number of inhabitants. Arnold showed that on a per capita basis more than twice as many Prussians were studying at a [graduate] university as Englishmen at an [undergraduate] college (*ibid.*, p. 135); at the secondary level, the contrast was even bigger; six times as many Prussians were enrolled in university-preparatory schools as English boys.

[26] Rather like the "major" in a first-rate American college.

[27] *A Hundred Years of Education* (London, 1960), p. 168. Compared to the late 19th century when Arnold, after the most thorough examination of continental school systems, came to the conclusion that the English bachelor's degree was the equivalent of the continental maturity, this represents a remarkable rise in standards.

[28] In a handful of American colleges a similar trend has just begun; in these the "major" is at university level. But the overwhelming majority of our liberal arts colleges still are roughly comparable to English colleges, as they were when Arnold called them luxury maturity schools. Our "vocational" colleges, on the other hand, are comparable only with vocational schools abroad and are academically below the maturity school.

[29] *The American Commonwealth* (London, 1890), vol. II, p. 557. Some remedial courses now given would rank as elementary by European standards.

To recapitulate: The modern continental university, unlike the English or American college (or the medieval university) is not concerned with general education but confines its teaching and research to the sciences upon which "learned" professions are founded.[33] Its task is through "systematic and deliberate effort to understand by principles, to discover the reasons of facts," [34] to perceive their interrelationships. Abroad, the university is the corporate organ to which society entrusts preservation, transmittal and augmentation of scientific truth about men, nature, the world, and the power that governs them all. Only a minority in any society has the intellectual aptitudes and aspirations required for study at this intellectual level; but what is accomplished by these few determines the cultural level of the whole of society.[35] Abroad, even confirmed democrats realize every society must educate its best minds, and that the education appropriate to them must always be beyond the reach of the masses.[36] In consequence, there is general agreement that an elite institution such as the continental university is of great social value. Europe's fantastic creativity in basic science during the last century is considered ample proof of the worth of this institution, dedicated exclusively to intellectual labor at the top of human capacity.

Because of this consensus we can speak of *the* continental university. Because there is no such consensus in our country we cannot speak of *the* American university. In the United States the best and the worst are too different to include them all in a single category. We habitually assign our universities different positions in an educational hierarchy which, for so large a country, is disturbingly narrow at the top. One of the principal reasons for the unequal standing of our universities is that we have no formal standard in this country nor are we informally agreed upon what is and what is not, properly speaking, "higher," or "academic" learning. Carrying the political doctrine of democracy and equality into the realm of the mind, we equate the most diverse kinds of intellectual enterprises, be they mere acquisition of technical skills or the most profound search into basic principles underlying natural and social phenomena. Everything becomes academic if group pressure can get it into a university.[37] Europe with its longer experience is familiar with this kind of educational inflation and does not mistake it for democracy. If we persist in looking at the continental university through egalitarian spectacles that focus only on numbers of students and blind us to the quality of the education they obtain, we shall continue to delude ourselves that the American college is equivalent to the continental university, the American high school (college-preparatory course) to the continental maturity school. This neat piece of semantic juggling produces a statistical superiority [38] in our favor that may be satisfactory to our national ego, but whom do we think we are fooling?

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[30] Switzerland as well!

[31] *Op. cit.*, p. 168.

[32] As fully matriculated students working toward a degree.

[33] No doctorates are granted by continental universities for work that is intellectually routine or, worse still, concerned merely with acquiring a "salable technical" skill; there are other institutions granting nonacademic diplomas for studies of a nonacademic nature. For a detailed and documented description of the whole process of reorganization, see Friedrich Paulsen, *Geschichte des gelehrten Unterrichts auf den deutschen Schulen und Universitaten vom Ausgang des Mittelalters bis zur Gegenwart* (Leipzig, 1919).

[34] Carr-Saunders and Wilson, *op. cit.*, p. 377.

[35] In times of trouble, when national life seems at an ebb, continental nations are inclined to establish a new or reorganize an old university. This faith that an institution devoted to high intellectual endeavors can raise a nation's cultural level and hence rejuvenate it seems very strange to most Americans. We have our rich land to fall back on, Europeans have only their minds. Thus at a time when Prussia had reached rock bottom and it seemed as though she would never again be an independent country, when the national exchequer was bare and poverty widespread, the king gave his consent to foundation of Berlin university and generous state subsidies to give it a good start. "The nation must replace through intellectual power what was lost for want of physical power." (Paulsen, *op. cit.* vol. II, p. 219.) Similarly, when Switzerland lay under the heel of Napoleon, when its ancient confederate government had been forcibly transformed into a centralized Helvetic Republic distasteful to its citizens, and its young men had been pressed into the French armies, a Swiss patriot first broached the idea of a Swiss national university where Swiss youth would acquire a new sense of Swiss unity. "This Institute will focus the intellectual forces of our nation, fuse its still separate nationalities, and serve as a repository for the culture of the three newly formed nations joined in Switzerland." He did not live to see his plans materialize in Article 27 of the 1818 constitution. So far only the Zurich technical institute has actually been established, but in time there will surely arise a national Swiss university as well. We are now witnessing Soviet Russia's attempt to move rapidly into top world position through prestige and power to be gained by scientific achievements. In this one respect, she is acting in accordance with an old Western tradition.

[36] There is a rumor the Russians now have a 5-year plan to try to raise the IQ of children.

We never cease admiring ourselves for our feeless high schools and our State universities. Once they were something special, but fees are disappearing rapidly abroad, not only in secondary schools but even in some universities (for example, in Denmark and some German states; also the famous *Grandes Écoles* where young Frenchmen, chosen strictly on merit, receive the highest kind of professional education are not only free but pay students' living expenses as well). Even where maturity schools or universities charge fees, they will rarely exceed half a dollar a week for the former, around $50 to $100 per year for the latter, less than the usual "incidentals" at many of our high schools and State universities.[39] Consider how steeply college costs have been rising in this country, beyond anything imaginable abroad. It costs much less to become a physician or lawyer abroad than here. Of course, neither we nor other democracies have found a way to overcome lack of motivation and the inequalities that come through differences in home backgrounds. Nor has any democracy as yet been willing to take on the entire job of housing, feeding, clothing, and educating all her university students—only Russia does that.

We are now faced with an overwhelming numbers problem; "the college doors are closing", and we must somehow find ways to educate a rapidly expanding student population. Perhaps the time has come to give thought to the possibility of cutting the cost of higher education by providing more (nonresidential) community colleges and by reducing the time it now takes to complete one's general education in the liberal arts and be ready for graduate professional studies.

Leaving aside such immeasurables as personal satisfactions and social connections, acquisition of poise and of a marital partner, why could not a nonresidential college be made *scholastically* as good as Ivy League colleges? It would be much less expensive, and we must find ways to cut expenses. Residential colleges are the most costly and luxurious institutions in which to acquire a general pre-university education. Here we have gone even beyond the idea of providing residential quarters; we feel that college students should not only be given a liberal education but that the "whole" man must be cared for, which means he (and his wife and children) must be entertained as well as housed. Jacques Barzun, in his Princeton lecture on "The Tyranny of Idealism in Education," remarked that American students were in search of a father, companionship, and a sweetheart. To facilitate this search, an elaborate community had to be created at great expense on every campus, so that *now the main fixed charge of a college or university is not the cost of its faculty and library, but the cost of this social, remedial, and recreational apparatus* (my italic). Is it not time we give serious thought to the question whether residential colleges are really suitable for a mass education system where the college population numbers several million?

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[37] Most of our universities appear to consider themselves public service stations where anything anybody wants must be taught and awarded a doctorate. As with all our degrees, the doctorate varies from excellent to poor, and means nothing unless one examines which institution has awarded it and for what type of studies. Many American doctorates are awarded for work that abroad would be considered wholly below academic levels. This is particularly true of the doctorates in education or school administration. No Swiss or other continental university would accept any of the following "learned" dissertations in part fulfillment of the requirements for a doctorate—as did one of our oldest and foremost universities: "Field Hockey in American Education with Special Emphasis on the Colleges of the Northwestern United States," "The Organization and Administration of College Bands," and, since the subject apparently had not been exhausted, also "The Organization and Development of Bands in Privately Controlled Colleges With Student Enrollment of Less Than 1,000 Students." Not only do we demand less of the doctoral candidate in education as far as his dissertation is concerned, we even waive for him the minimal requirement of possessing some slight reading knowledge in two foreign languages. In *our* academic world, education ranks with business and agriculture at the bottom of the scholastic totem pole. It is significant that in Switzerland, the doctorate of maturity schoolteachers is considered scholastically more difficult than doctorates in the social sciences, even law.

[38] As when we lump together all our 1,800 so-called "higher" educational institutions and come up with something like 25 percent of Americans pursuing academic studies, compared to 5 or 6 percent attending universities abroad. Someone ought to make a careful study of the *content* of American degrees and put an end to this irresponsible bragging.

[39] As with us, children of nonresidents who pay no local taxes are charged fees based on what it costs to educate them.

It seems doubtful too that we will much longer be able to afford the educational stretchout that needlessly keeps our bright young people from beginning (graduate) professional studies at the time when this is normal abroad (age 18–19). One solution we might consider is to leave the present leisurely sequence to those who prefer it, but to set up a parallel course for students who wish to get more rapidly through their general liberal arts course and into professional studies. We now have to provide new educational facilities for some 2 million additional children each year, with the number increasing steadily. This gives us an opportunity to set up such a parallel course without interfering with the jobs of teachers and administrators holding positions in the present system and without robbing any child of the opportunity to obtain diplomas and degrees in the present easy way.

The annual increment of school children is now about 5 percent of total public school population. We could thus give that many of our young people an opportunity to pursue an educational program equal to the best that is available to their contemporaries abroad and to do it in approximately the same length of time. Since it costs much less to teach calculus or French than vocational subjects and life-adjustment trivia, funds would be available to pay better salaries and thus attract better teachers without having to spend more tax money.

Additional teachers are needed anyway, hence one may hope there will not be enough educationist opposition to scuttle the program. It should not be difficult to convince the American public that it is not "undemocratic" to permit our children a choice between easy life adjustment and tough basic education, especially when nobody else's education is thereby slighted. Some consideration ought to be given to the possibility of devising a combination of junior and senior high school and junior college that would be comparable to the continental maturity school and get students ready for graduate study no later than age 20. The reader may judge for himself how the maturity diploma compares with the *average* American bachelor degree by turning to the next chapter.

AUTHOR'S NOTE.—In subsequent chapter of the book an attempt is made to assess the scholastic levels achieved by Swiss students who complete academic secondary schools and pass the difficult maturity examination that earns them the Swiss baccalaureat or maturity degree. In the annex to the book numerous examination questions, as well as a detailed curriculum of one such higher secondary school, are given and these are contrasted with scholastic achievements of American bachelor degree holders.

It seems to me important that we recognize the true position of the American bachelor's degree. In this connection I might mention that this was well understood before World War I when thousands of American college graduates went abroad to study at European, most often at German universities. We did not at that time have adequate graduate facilities and our professional schools were quite inferior, especially our medical schools. As long as our students came with degrees awarded by old established Eastern colleges, they had no difficulty matriculating in European universities; their bachelor's degree—attained in 16 years—was given equivalence to the continental baccalaureate—at that time attained in 12 years. But so many of our newer colleges, especially in the West, were awarding degrees for work that abroad was considered far below baccalaureate standing that in 1905 the University of Berlin announced it would recognize only degrees of colleges that were members of the American Association of Universities. The University of Berlin was prepared also to recognize degrees of any college for whose scholastic standing the association was willing to vouch. This was a ticklish responsibility and the association procrastinated. Later it did, however, begin to accredit colleges. When it stopped the practice in 1948 it had given its stamp of approval to but one-fifth of our institutions of higher learning.

In 1910 Congress appointed a specialist in higher education to the U.S. Bureau of Education. The first appointee, Kendric C. Babcock, decided to try to classify our colleges. The need for some such classification had become pressing. Without Federal or State standards in higher education, the value of a student's college work was wholly indeterminate. The student not only had difficulty being admitted to foreign universities, but he had equal difficulty transferring credits from one American college to another. Babcock chose as his criterion for evaluating a college the quality of the work done by its bachelor's degree holders in graduate and professional studies; a very practical and sensible means of judging the scholastic value of the degree. After the most painstaking research his report was ready for the printer when, unfortunately, the press got wind of it, and so much political trouble ensued that President Taft decided to stop publication.

This was our first and last attempt at setting a national standard for the college. As a later specialist remarked ruefully, "The Bureau learned that there are no second- and third- and fourth-class colleges; that it was an outrage and infamy so to designate institutions whose sons reflected honor on the State and the Nation" (William K. Selden, *Accreditation*, Harper's 1960, p. 47). What abroad is considered a matter of factual information takes on emotional overtones here.

It will doubtless be difficult for many Americans to face educational reality. By equating our college with the European university we have for many years been able to feel immensely superior to Europe. Witness the absurd boast, "England has only 2 universities, France has 4, but in Ohio alone we have 37 colleges." Sorokin quotes it in his book *The Crisis of Our Age* (p. 71). I have seen statements by educators to the effect that more American Negroes go to college than Englishmen get a university education. Recently a professor of sociology compared English education unfavorably with education in the Philippines on the grounds that three times more Filipinos were enrolled in college than Englishmen in their universities. He also noted with pride that in proportion to population we had as many persons on our college faculties as England has students enrolled for a first university degree (Seymour Lipset, "Sex, Age, and Education," *The New Leader*, Nov. 21, 1960, p. 17).

This sort of careless reportage is prevalent; it is rooted I think in colossal ignorance of European education. One might argue that it is a harmless self-delusion and makes people happy, so why force the truth on them. The truth, alas, must be brought out or we shall not be able to mobilize public opinion behind school reform, and today excellence of schooling has become an absolute necessity for our own future well-being and that of our children.

I notice that in his recent book, *Slums and Suburbs*, Dr. Conant proposes that "the leading professional schools of law and medicine and graduate schools of arts and sciences should in the future require candidates to pass a set of examinations which would demonstrate a mastery of subjects, *somewhat comparable to that for entrance into a European university*" (my italic); that is, an examination comparable to the European baccalaureate or maturity degree. He outlines suggestions for such an examination, pointing out, however, that the level of accomplishment proposed by him "is less than that attained by Europeans." [40] Thus he appears to recognize that after 16 years at school and college young Americans—even those bright enough to wish to undertake graduate professional studies—are scholastically less advanced than young Europeans after 12 to 13 years of schooling.

EUROPE SURPRISINGLY UNITED IN EDUCATION

Mr. CANNON. Admiral Rickover, you say European children are several years ahead of ours. How do you account for that?

Admiral RICKOVER. It seems to me inevitable that they should be scholastically ahead of ours since their schools concentrate on what we call the "solids." This is universally the case abroad. You would be amazed how closely European school curriculums resemble each other. Europe is surprisingly united in education. Whether it is the curriculum of a primary school or of any of the several types of secondary schools they have over there, you find the same subjects in the various national school systems, and usually they are given for just about the same number of periods a week.

This similarity is not produced by deliberate agreement. It stems from common educational aims which were first formulated in the Middle Ages when Europe was united under its common educator, the church. Continental universities resemble one another so closely that "wandering" of students from one university to another across national borders, as was so common in the Middle Ages, is still quite easy. And since in every national school system the university caps the whole educational enterprise, it has a unifying influence. All schools, even those not university preparatory in intent, try to keep the road to the universtiy open for their students. They can only do this by setting their students a scholastic program that may differ in learning pace and in depth and breadth of learning, but not in the *kind* of knowledge that is pursued. In such school systems life-adjustment training finds no place.

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[40] (*Slums and Suburbs*, New York, 1961, pp. 94–95.)

EXCHANGE OF INFORMATION AMONG EUROPEAN EDUCATORS

Then, too, it is common practice among European education authorities to keep informed on what goes on in neighboring countries. Education is highly valued, and no country wants to fall behind in school standards. Booklets are available that describe the various national school systems and, I may say, they do so with admirable objectivity and a total absence of the bragging we find here. European educators rarely take the position that their own schools are unique and that what other school systems do has no relevance.

An official publication of the English Ministry of Education offering suggestions to teachers as to how to teach English, for instance, devotes an entire chapter to a detailed description of how French teachers teach French—together with a curriculum showing how much time French schools allot to study of their mother tongue. The voluminous Crowther Report of 1959, which discusses the current status of English education from ages 15 to 18 and submits proposals for expansion of educational opportunities and facilities, has in its annex a detailed report on "Technical Education and Vocational Training in Western Europe"—Germany, France, and Holland.

A century ago, when England was debating whether or not to establish a state system of education, the central education authorities repeatedly sent Matthew Arnold, one of their school inspectors, to the Continent to observe and report on public school systems across the channel. In the 1830's the French Government sent Victor Cousin to Prussia to report on the Prussian schools. And, incidentally, we too followed that custom. In 1837 the Ohio State Legislature, then contemplating establishment of common schools, sent Professor Stowe to report on common schools abroad.

SCOPE OF AMERICAN EDUCATION TOO BROAD

When one confronts them with evidence that our schools do not do as well scholastically as the schools of other advanced countries, American educationists counter with the claim that our schools do better in *other* respects; that our children are more socially poised, date earlier, and speak in public with greater ease. I think they could excel in all this and still know how to spell and do their sums and know history. As for teaching them things normally learned at home, it makes no sense to my thinking to use such expensive institutions as schools to do these family tasks. Schoolchildren who come from defective homes and need mothering or after-school care ought to receive this in social welfare agencies, settlement, or community houses. A teacher is too valuable a national asset to be diverted to chores someone else can do. Moreover, the qualities that make a good teacher are not identical with the qualities that make a good mother substitute. Few teachers will possess both.

Countries shift places in the educational lineup, moving forward or falling behind as they succeed or fail in keeping their school systems in line with the changing needs of changing times. But at all times those countries are in the lead that put the school's technical task ahead of any other objective they wish the schools to pursue. Nineteenth century England was educationally behind the Continent, partly because the English wanted their schools to serve particular social classes. Social homogeneity was more important to them than the intellectual caliber of students or the content of the curriculum. What the students learned in class seemed to the English less important than what they might learn by boarding together with children from the same social background.

SOCIAL PURPOSES EMPHASIZED OVER THE SCHOOL'S TECHNICAL TASK

I don't want to go into this in detail now. I will discuss it later. The point I want to make now is that today *we* are educationally behind Europe because *we* want our schools to serve a *social* purpose that we put above the school's *technical* task. This is exactly what the English did a century ago, only our purpose is the opposite one. Our schools are being made to level out social differences among the children. They are being used to put an end to class differences. Seymour Lipset, professor of sociology at the University of California, expressed the official attitude of our school system when he wrote—

> the American high school system has been designed for many generations to socialize the barbarians, that is, to take into the larger social system children from * * * lower class backgrounds, and to give them the same educational background as those from the privileged classes. In a sense, the latter have been held back in order to permit the others to advance.

Now this would be a splendid idea if the educators were speaking of equalizing our children's educational chances *by giving every child the same opportunity to realize his innate potentialities through first-rate school instruction in basic subjects*—with each child being urged to go as far as he is willing and able to go, and society picking up the tab for the total cost of schooling. But this is not what the educators want. They would like to use our common schools for the purpose of wiping out all the inequalities children suffer, whether because of differences in native endowment or because of differences in home background. Equalization, in other words, appears to be the primary function of the American public school system, to which education itself is to be sacrificed when the two cannot be reconciled. And, since our schoolmen consistently confound social and economic differences with intellectual differences, they make it extremely difficult for our schools to do their technical task, for they demand, in effect, that the principal factor in education, the human mind, be disregarded.

SCHOLASTIC POTENTIAL INDICATED BY IQ

To any sincere democrat it is distressing that individuals should vary so greatly in the particular kind of intelligence that determines how far they can go scholastically. Using the Stanford Binet IQ classification, we find that just 30 percent of our children have an IQ level above 110, pretty much the minimum required for any kind of academic success. A few points in the IQ scale can make a great difference. Thus children with an IQ of 115—about 15 percent of the population have 115 plus—have a much better chance of doing well in an academic school program. Contrariwise, those with 105 have little chance to succeed academically unless there is the strongest kind of motivation and a great deal of excellent teaching or, better still, tutoring. About 46 percent have an IQ between 90 and 110, that is, average intelligence. Roughly 15 percent have an IQ between 80 and 90; that is they still rate normal but have sluggish minds. Below that you get into the subnormal.

You can deprecate IQ tests and argue that they are biased in favor of children who are healthy, well fed, come from homes where they absorb a lot of knowledge just listening to adult conversation, and so on. This may invalidate individual cases but the overall classification seems to be well proven. Unless we discover new ways to stimulate children so they will use their minds more intensively, hold their attention longer, and develop their power of observation and their memory, we are pretty well stopped from giving a genuinely "higher", that is "academic" type of secondary education to more than about 30 percent.

SCHOOL DROPOUTS IN EUROPE

European educators are greatly disturbed about the voluntary dropout of many bright children from schools that are tuition free, and which they could finish if they studied hard. A similar dropout problem also exists among children of average ability and there seems to be nothing much that can be done to remedy this. The English recently made a careful study among national servicemen, who represent a cross section of English youth, in order to discover their reasons for dropping out of school. Few could give a valid excuse, and this was true of students in the higher secondary schools as well as those in the lower secondary schools.

An astonishingly small number—only 2 to 3 percent—gave as their reason for dropping out that schoolwork was too difficult. Some 20 percent said they had to go to work to help out at home. The rest quit for such frivolous reasons as that they were fed up with school; all their friends were getting jobs; they wanted spending money and a job was available, et cetera. The study did bring out one encouraging fact: Almost half of those interrogated now regretted they had dropped out. The English hope this means that there will be an educational spiral, each generation seeing a bit more clearly that education is a good thing and urging the next generation to study more and longer.

CAPABLE EUROPEAN CHILDREN ENCOURAGED TO PURSUE RIGOROUS ACADEMIC PROGRAM

All school systems have been caught napping by the sudden rise in demand for professional and semiprofessional people with an academic education. Great efforts are being made abroad to induce more children to pursue a rigorous academic secondary school program. It is pretty generally believed that they will have to come from the top 30 percent. Today no country has succeeded in motivating *all* of these 30 percent to pursue such a rigorous school program. Money has little to do with this situation. Motivation is the principal factor and family support is the best spur to intellectual effort. The English experience has been that children from educated homes consistently surpass their promise at age 11, when the sorting into different secondary schools takes place, while children from homes where education is not valued often do not live up to their intellectual potential.

Even bright children have to work hard to obtain a good education. In their late teens most young people go through a phase of being fed up with school and wanting to become independent and earn their own living. This is when family encouragement becomes so important. It isn't a matter of wealth. It isn't always even a matter of parental education. It is rather a matter of parents recognizing the importance of learning, and having the kind of relationship with their children that will enable them to counteract teenage revolt against the school.

Bright people whose mental powers have been developed through a rigorous academic education have it in them to contribute enormously to society. A country that succeeded in inducing every child with the requisite talent to pursue an academic education would not only enhance public well-being but would excel in most areas that affect a nation's position in the world. I should judge that Russia at the moment gets the largest percentage of children through her academically oriented secondary schools and into graduate university studies. Some European countries, while lacking the motivation a totalitarian state can provide, have reached a point where at least no talented child is *held back* by lack of money or educational opportunity. The talented are discovered early and receive the best schooling free of charge. Their university fees and living expenses are covered by scholarship. Nothing but their own refusal to do the necessary hard work will prevent them from reaching the educational top. England has pretty much reached this point. Of all European countries, she is said to have the largest percentage of workers' children in her universities.

CONTRASTING AMERICAN SITUATION

The situation in this country is not as good. Whether a talented child is discovered and receives an appropriate education depends on luck—on where he goes to school. Geographic inequalities are enormous in this country. Nothing like it is to be found in leading European nations. For instance, assessed property valuations behind a school child may vary from $7,500 to $100,000, and expenditure per child by one State may be three times that by another State. It is a rare school anywhere in this country where children in the top ability range will have a chance to move ahead at anything like the pace that is customary abroad, and the few schools that cater to bright students are periodically under attack by educationists who consider them elitist.

SUPERIORITY OF EUROPE'S ACADEMIC SECONDARY SCHOOLS

One 3-year high school for bright students in New York City—Townsend Harris—was abolished for "undemocratically" doing in 3 years what it takes average children 4 years to accomplish! The Boston Latin School, the oldest secondary school in the United States, founded 3 years earlier than Harvard, was for years ignored by the educators. I hear that its high standards are now being destroyed so as to fit it into the regular city school system. We have in all this big land of ours no public school attaining the scholastic levels of Europe's academic secondary schools, the lycees, maturity schools, gymnasia, grammar schools, et cetera. Europe has large numbers of these schools. You can usually find one in towns with no more than 10,000 population. In smaller towns they will often have an incomplete secondary school that carries you through age 16, after which students will have to transfer to a school in a larger town. All these academic secondary schools are day schools, so their cost to family and public purse is much less than our residential colleges. Yet they lead to an excellent baccalaureat.

In these academic secondary schools Europe has ready at hand efficient, inexpensive institutions serving her talented youth. The growing need for professionals and semiprofessionals can therefore be met in Europe by expanding these schools and inducing able children to remain in them long enough to complete the full course. For us, however, the professional shortage poses the far more difficult problem of creating school facilities equivalent to those of Europe, but in a public school system that does not now have these facilities. We will not obtain the professionals we so urgently need until we create these school facilities.

BUT WE REFUSE TO RECOGNIZE THIS URGENT NECESSITY

But we refuse to recognize this urgent necessity. It is true that a few students in our better high schools now have a chance to do some college work that may win them advance standing and thus reduce the time it takes to obtain a bachelor's degree. A very few may receive credit for as much as a year of college. Given the caliber of our high school teachers, it seems to me doubtful that this attempt to help our talented youth can be sufficiently expanded. We need a more radical solution. Bright youngsters ought not to be kept together with the average beyond the elementary grades. They deserve to be given as good an education as similar children receive abroad. In other words, from age 11 or so onward they deserve education comparable to the higher or academic secondary school abroad.

The chief obstacle to this sensible solution is educationist insistence that separate schooling is "undemocratic" and would create an elite at public expense. Well, we are constantly talking of college students as "future" leaders, and almost half these students are in publicly supported State universities. For some inexplicable reason our educators find it satisfactory to accept separation at age 18 but not at 11 or 12. But 18 is too late. Having sat bored through the public schools for 12 long years many of our bright children have lost intellectual drive and acquired bad study habits.

What our educators seem unable to grasp is that the teens are the best learning years. If you force bright youngsters to waste these years in the name of "democratic" common schooling, you can't make it up to them later, even if you offered all of them a free college education. There is, as the Bible says in Ecclesiastes II, "to everything * * * a season, and a time to every purpose under the heaven." The time for bright children to get their teeth into higher mathematics, foreign languages, physics, chemistry, and other university preparatory subjects is from about 11 to their late teens. These are the years when students can most easily absorb these subjects and when they can also concentrate on their studies without being distracted by early family responsibilities which plague many of our college and university students.

SERIOUS STUDY HANDICAPPED UNDER COMPREHENSIVE SCHOOLING

Comprehensive schooling, continued beyond the elementary grades, makes any kind of serious study impossible. For differences in IQ levels result year by year in greater gaps in mental ages and still greater gaps in achievement levels. In his book *The Restoration of Learning,* Arthur Bestor, one of the most scholarly critics of American education, spells this out so clearly that anybody can understand the problem. The range in *mental* age, he writes, increases rapidly. In the first grade of an average school with a representative group of children the top and bottom 2 percent of the intelligence spectrum will be three and a half years apart, the broad middle group will have a spread of a little over 2 years. In the sixth grade, the gaps will be respectively 6.4 and 3.2 years; in the twelfth grade, 8.4 and 4.2 years. In all grades the gap in *achievement* levels is a year or two greater so that in the sixth grade, for instance, the range of achievement may be as high as 7 to 8 years. Studies made in English composition, literary knowledge, science, geography, history, arithmetic reasoning, etc., show that "above the primary level almost the complete range of elementary school achievement is present in *every* grade of high school."

A similar situation exists in most of our colleges. Bestor quotes comprehensive studies showing that "if the graduating class had been selected from the entire student body on the basis of achievement test scores instead of from the senior class on the basis of credits earned, only 28 percent of the senior class would have graduated. The remainder of the graduates would have been made up of 21 percent of the juniors, 19 percent of the sophomores, and 15 percent of the freshmen." Furthermore, that nearly 10 percent of the college seniors "had scores below the average high school senior."

A majority of our colleges admit B and C students, and in some it is still possible for a student to accumulate the requisite credits for a bachelor's degree by picking courses in different subjects that are all or nearly all at freshman level. When we congratulate ourselves that admissions requirements are rising rapidly, we tend to forget that only a minority of colleges set academic standards of any rigor. A few years ago this was 16 percent of the colleges; now it is just under 20 percent. These figures include colleges with widely varying standards. Less than 1 percent of American freshmen are enrolled in an Ivy League college or in institutions of the caliber of MIT or Cal Tech.

EDUCATION FOR ALL: "LIFE ADJUSTMENT" TRAINING

Unwillingness to face the impossibility in a comprehensive school of genuinely educating children whose intelligence varies too greatly has led American educationists to search desperately for *something* that *all* children can study together, and this something turns out to be life-adjustment training. It is inevitable that when you place equalization of all differences among children first on the list of the school's function, you have to level the curriculum down to the capacity of children of average or below average intelligence.

There are two ways this can be accomplished. The first way is to have *all* children study the same elementary subjects for 12 years.

Even progressive educationists can see that a good third of the children will have grasped these elementary subjects after 6 years or so of schooling, and would then just be sitting in class doing nothing. So, if schooling *must* be identical for all children, there is the second way: introduce life-adjustment courses or something of the kind that can be stretched over any number of years since there are no fixed goals and no specific skills are required.

For decades the educationists have been busy drawing up model school curricula and making lists of the "objectives" for which our schools should strive. You will find that *basic education* plays a small part in these "objectives." There is much talk of "common needs" of all children, to be served by courses in "common learnings" which turn out to be courses in social graces, good grooming, and all sorts of things that go under the term "good deportment" and which used to be taught at home. Also there is much vague talk about "good" citizenship but very little emphasis on really thorough teaching of our own history and that of other major countries; of our own Government and those of other nations; of the real working of the "democratic process" and the citizen's part in it. These are intellectual subjects, and in many cases our teachers lack the qualifications to teach them.

Periodically someone makes a study of what our high schools have managed to teach of American history and government. Invariably vast areas of ignorance are exposed. There is a general outcry at the time, but in a short while everything goes on placidly as before. A recent Elmo Roper poll disclosed "that 70 percent of the American people do not know the length of the term of U.S. Senators; that 56 percent cannot name either of the two Senators from their own home State; that they haven't the vaguest notion of what a tariff is; that Americans are all in favor of selling American goods abroad but not for buying European goods—as though that were possible," etc. Educationists talk a lot about "teaching democracy" but the record, as well as what we see, show they don't succeed very well.

AN NEA STUDY: "EDUCATION FOR ALL AMERICAN YOUTH"

In one of the most influential studies of the function and curriculum of the high school, the Educational Policies Commission of the National Educational Association, coined the expression "Education or *all* American Youth." Harold Spears, at the time assistant superintendent of the San Francisco public schools, said of this phrase that "it caught the spirit of America's search for a truly democratic secondary school." He summed up the commission's suggested high school curriculum under 14 headings, none of them even remotely concerned with what I have called the school's *technical* task. That the school must be comprehensive is the first rule laid down by the commission. This is spelled out further by demanding that schooling be *identical in its entirety* to age 16, and *for the major part of the school-day* thereafter to age 18. The relevant statements are: "In its broad outlines there is to be the same curriculum for all pupils up through age 16," and "up through 18" there is to be "a 2- or 3-hour core course in common learnings, meeting needs in citizenship, economics, family living, appreciation of literature and the arts, and use of the English language." All children in the 11th and 12th grades are to study this strange conglomerate together. By that age, as I mentioned earlier, the range in mental age will span at least 4 and maybe 8 years, and achievement levels will vary still more. In fact, at that age the top quarter of the class could be studying academic subjects that are beyond the capacity of the average and below average three quarters.

But the commission's curriculum is not concerned with academic studies. It advocates that students conduct "community surveys each year," and that "community studies be as prevalent as book study." The curriculum is to include "family life education for all students" and student counselors are to be "as concerned over a student's first serious love affair as her choice of a college."

So much for the "model high school curriculum." The commission sets out the school's "educational" goals under 10 headings. Only the last one is concerned with what I define as the school's *technical* task. It says, "All youth need to grow in their ability to think rationally, to express their thoughts clearly, and to read and listen with understanding." Two others have some vague connection with basic education: All youth "need opportunities to develop their capacities to appreciate beauty in literature, art, music, and nature" and all need "to understand the methods of science, the influence of science on human life, and the main scientific facts concerning the nature of the world and man." The other seven points have to do with "salable skills," good health, understanding of rights and duties of citizens, family life, skill in purchasing goods and services, leisure time activities, how to live cooperatively, etc.

CRITICISM OF THE COMPREHENSIVE SCHOOL

When schools abandon their *technical* task, as ours have done, because it cannot be done in an undifferentiated comprehensive school system, they shirk their responsibility. Education, like politics, is the "art of the possible." If the school cannot develop its pupils' intellectual powers to their highest potential because serious studies cannot be done when children differing widely in mental age are kept together, it follows that the only *possible* solution is to abandon comprehensive schooling at the point when these differences become unmanageable—about age 11–12. Otherwise *no* pupil gets an intellectually challenging education.

This, in my opinion, is the chief lesson to be learned from European education. It makes no sense to reject it as "class" or "aristocratic" education for, as I have said, when education is *free* and open to *all* children it is by definition "democratic." Where American educators go astray is that they try to transfer *political* concepts of democracy into the realm of the *mind*. We are committed to government by the people, with every normal adult assured an equal vote and all citizens equal before the law. This has given us the freest and best form of government. But when *political* principles are mechanically carried into *education* we get *non*education. For education cannot be "handed" out. To be worth anything at all, it must be *earned*. It is just this that the educators refuse to accept.

One cannot steep oneself, as I have done, in official and nonofficial writings of educational officialdom without being made aware of their desire to make academic reward the "democratic right" of every American child; but a right that carries no corresponding obligation. This is why we have automatic promotion; why we have report cards that camouflage the student's *real* standing in class; report cards that do not show the extent to which he has attained a specified grade achievement level. What is abroad normal procedure, the teacher's evaluation of a pupil's schoolwork to determine whether he is ready for promotion to a higher grade or a higher school, is represented here as unhealthy cutthroat competition from which our children must be protected at all costs. All our children are entitled to "equal education and equal status" in school, the educators say. We don't "judge" our children. Each is unique and valuable and has his own special talents. In our schools, the child "competes only against himself." He would suffer pain and loss of face if he were not allowed to move ahead with his "peer group." And so on, and on, and on.

This seems to me extraordinarily muddled thinking. The educators are arguing in a circle. All our children are entitled to higher education, they say. Not to promote them just because they've been unable or unwilling to do their schoolwork would be "unfair." But if they are promoted without being ready for the next stage in education, then instead of progressing up the educational ladder they actually stand still. This is camouflaged by giving the same step on the ladder a higher designation each year. Our educators do this all the time. They hand out high school diplomas to children who haven't attained elementary achievement levels, and college diplomas to students who haven't even done the work of a decent college preparatory course. And some of our Ph. D.'s would not rate a baccalaureate in any European country.

To quote Mr. Spears again. He describes in glowing terms a typical high school commencement. Children marching in college caps and gowns, the whole community present to applaud as each receives his parchment scroll. He goes on to say:

> In keeping with the school's guiding star of equality to all American youth, these ceremonial robes have been accepted by school administrators chiefly because of the equalizing effect upon the dress of a class of graduates representing the country's most extreme range of economic backgrounds.

Ceremonial robes that for centuries were earned by students who had completed a rigorous university course are thus being "used" to give a spurious glamor to a high school course that for the majority of students represents no more than the elementary school course abroad.

Spears goes on to say:

> Regardless of the variation of high school courses and the range of scholastic achievement that are presented by the graduates as evidence of accomplishment, straight thinking and democratically minded school administrators have long since adopted the idea of the same diploma for all.

And he notes with approval that—

> no longer does the diploma in its wording discriminate among the graduates, as was once the case when it carried the name of the course in which the student went through school, consequently implying that the accomplishments of the youth who did not take the highly academic lane were less worthy.

Mr. Spears is a good reporter. He describes accurately how educators have felt for decades. Only in recent years has public demand, spurred by the critics and sputnik, made the educators shift their viewpoint slightly. One cannot help feeling that this shift has been in response to pressure and does not represent a genuine change of heart.

Procedures that are essential for the school's technical task are rejected by the educators because they read into them social discrimination. They would not do this in sports or in art or music. Nobody suggests that to train star athletes is "elitist"; that all youth of the same age must train together and participate together in football games, and that this must include the lame and the halt. Nobody expects that tone-deaf children, children of average musical talent, and children of potential concert ability should all study the piano together, under the same teacher, each receiving the same diploma at the end of the course. Differences are perhaps easier to see in these cases. But educators ought to be able to recognize the parallel with intellectual differences. A tone-deaf child obviously would derive no benefit from being instructed in the same class with potential Van Cliburns or Leonard Bernsteins; neither is an average or below average child benefited by sitting in the same class with bright children. The notion that the bright ones will act as a sort of yeast is nonsensical; isn't this supposed to be the function of the teacher? Besides, isn't it a fantastic presumption to misuse our small treasure of talented youth by turning them into stimulators of slow learners, thus sacrificing their own educational needs? To me this is a kind of child labor, quite as bad as employing children in factories or mines.

The educators, however, are firmly committed to what Conant calls—

> a common core of general education which will unite in one cultural pattern the future carpenter, factory worker, bishop, lawyer, doctor, sales manager, professor, and garage mechanic—

all of them supposedly learning to get along together and absorbing the proper democratic attitudes. This is simply asking for the impossible, but to this end educators cheerfully sacrifice our bright children's best learning years.

In the same breath that American educators reject as "undemocratic" separate secondary schools catering to varied abilities and educational objectives they reverse themselves and talk a great deal of the uniqueness of each child and the teacher's duty to provide him with his proper education. But how can our overworked teachers cater to 30 or more of these unique entities? You cannot provide individual tutoring in any mass education system. It is also not necessary to do so.

Children are unique but they also have a great deal in common. If they are to pursue serious basic studies, the most important thing they must have in common with their classmates is intelligence; intelligence within a range that permits them all to do their studies together. Additionally they must have reached approximately the same achievement levels so that they can move ahead, equipped with the same background knowledge. Children will then learn a great deal through the mutual stimulus of intellectual effort in which all can participate. In hearings before the Senate Labor and Public Welfare Committee, Morris Meister, at the time principal of the Bronx High School of Science in New York, spoke of this stimulus among his own highly intelligent students.

> The impact of good mind upon good mind raises the sights, and raises the standards, and gives you the kind of excellence that I think we need in this day and age.

When children vary greatly in intelligence you get no such stimulus; their minds are too far apart to have an impact on each other. How vast is the learning gap between an *average* high school class and a class in the Bronx High School of Science was described by Mr. Meister who had taught physics in both. The bright children in the Bronx school, he found "learned faster, they learned more deeply, and they understood better. Things that I would take two or three periods to explain in the average school would be done here in 5 minutes."

EUROPEAN SCHOLASTIC SUPERIORITY: SUMMARY

I will summarize my answer to your question, Mr. Chairman, as to why European children are ahead of ours scholastically:

First, the schools concentrate on their *technical* task and, since this task is to develop children's minds, European schools adopt procedures that take account of intellectual differences. The English "stream" children even in the primary grades. "Stream" is the English term for ability grouping. Within particular streams, the English sometimes divide children into so-called "sets" for particular subjects. These "sets" take account of the fact that within any ability level, children often have special aptitude for the linguistic or the mathematics-science field or for some other subject. Thus a student may in a particular subject be in the same class with children from several streams. Perhaps he is in the top stream generally but is not good at foreign languages. In his French lessons he may be with children who are in general somewhat less intelligent than he but who have a talent for foreign languages. Children abroad usually take these groupings in their stride, recognizing them for the *technical* procedures they are.

All European school systems have several kinds of secondary schools, adapted to the learning pace of children and to their educational objectives. In all of these different schools European children move ahead faster than children of similar ability do in our schools. For this reason they finish a given educational course in fewer years.

Second, as part of their acceptance of differences in ability, European schools recognize that teachers must be more intelligent than the average of the classes they teach and must know more about the the subjects they teach than their students. Hence teachers in the upper or academic secondary schools must meet more stringent educational requirements than those in the lower tracks.

With better teachers, more can be taught in school. Then, too, abroad schooling is taken seriously by all concerned. There is more homework and there are few distractions during schooltime. Fun and games are relegated to after hours.

Finally, children receive much more classroom instruction in any given school year. The schoolday is longer and so is the school year. On the Continent a little over 8 years contain as many hours of class instruction as do 12 years here; in England, it takes 10 years to cover the same number of class hours. We never take this important point into consideration when we congratulate ourselves on giving more schooling to more children than any other country. Count up the time actually spent in school—not in homestudy period but under instruction by the teacher—and we no longer have any advantage in time. In fact, since just under half our children do not even complete high school, this half receive *less* schooling than children in any of the leading European countries where attendance during the compulsory period is practically 100 percent. And 8 to 9 years has been the compulsory period on the Continent for a very long time, while in England every child must attend school for 10 years, with an extension to 11 currently being debated.

The swollen school attendance figures that give us so much pleasure turn out, on examination, to reflect merely the unconscionable stretchout in American education. Now that explosive population growth threatens to outrun our ability to provide enough classrooms and teachers, this stretchout has become intolerable. Unless we overcome it, we shall not even be able to give future young Americans the kind of education our children now receive—an education quite inadequate to their needs and to the needs of our country.

RELEVANCE OF ENGLISH SCHOOL REFORM TO AMERICAN EDUCATIONAL ISSUES

Mr. CANNON. We know you have for some years been studying different European school systems. Is it your contention that the English have the best system?

Admiral RICKOVER. No, sir. As a matter of fact they are only now catching up with continental European education. But just because they have been educationally behind the most advanced continental nations, they have had much the same difficulties we have at the moment in our own country. All through the 19th century the English struggled with school reform. Many of the obstacles they had to overcome are not unlike those we must overcome if we are to upgrade American education. And England, too, was slow to recognize her educational deficiencies and slow to overcome them. In the end, what really spurred her on was competition from other countries that had established better public school systems. These countries were able to move faster because they had authoritarian governments while England, like ourselves, is what I call a Consensus Country. That is, her citizens are politically free and, before government can expand into hitherto private areas, Englishmen like Americans have to be persuaded that this is necessary and in the national interest.

England could not improve her schools as fast as this was done by her chief 19th century rivals on the Continent, particularly Prussia. Prussia was what I call a Decree Country, that is her authoritarian government, or rather her absolute monarch, could decree school reform without consulting his people. Our chief rivals today are the totalitarian countries and they, too, simply decree what their schools are to do, while we must first develop a public consensus for reform. So the English experience seems to me particularly relevant for us.

The English were slow to get started, but in the last two decades they have moved forward so fast that they have almost closed the education gap between themselves and the Continent. And in doing so, they have invented a number of ingenious procedures that seem to me the kind we might like to copy or adapt to our own needs. Then, too, it is easier for us to learn from them because of the common heritage we share and the similarity in our basic attitudes toward life and the relations of people to each other and to government. This gives me hope that we will observe England's educational practices sympathetically and with an open mind. In the past we have borrowed much from her and found it good. It is, of course, up to the American people to decide whether they want to profit from successful techniques evolved by the British to solve essentially similar education problems which plague us.

In choosing to describe a particular school system, I take into consideration the unfortunate fact that American educationists lack the true professional's attitude toward foreign techniques. They inevitably bring up American dislike for this or that foreign social, economic, or political practice to discredit what the schools accomplish scholastically. As I said before, I consider the national setting irrelevant when it comes to judging how well a particular school system does its *technical* task. But, in order to counteract the educationists, I try to pick schools from countries we more or less approve of: the Dutch, Swiss, and English, rather than the French or German school systems, even though the latter are as good school systems as the former.

VALUE OF STUDYING OTHER EUROPEAN SCHOOL SYSTEMS

The French, for instance, could give us pointers on a number of educational matters but if I brought that out, the stereotyped reply of the educational establishment would be, "Look at the political mess they are in." The French are particularly successful in preserving their beautiful language from vulgar and sloppy colloquialisms and they manage to pass it on to *all* their schoolchildren in its best form. They also have gone very far in making educational progress entirely a matter of merit. Their famous *Grandes Écoles* or Great Schools, which train their professional people, have very tough admissions requirements and nothing but merit gets you into them. But once in, all your expenses are paid. They were one of the first countries to assume the full cost of elementary schoolteacher education in return for a commitment to teach for 10 years or to pay back the cost in annual installments. We now have something like it in our Defense Education Act, but the French have had it for 80 years.

EUROPEAN ORIGIN OF THE PUBLIC SCHOOL

The Germanic countries pioneered the whole concept of universal free and compulsory elementary education, of part-time continuation schooling combined with apprenticeship and of tax-supported secondary and university education. With part of the cost of postelementary school education borne by society, fees could be kept nominal. As long ago as 1860, Matthew Arnold, the English school reformer, found to his surprise that Prussian academic secondary schools were not only so cheap that middle-class children could and did attend them but that there were many scholarships also. Overall they amounted to 10 percent of the places in these schools.

I am amazed how many people in this country mistakenly believe we had the world's first universal primary school system. Before the progressives isolated us from the world of education abroad, educated Americans would not have been deluded on this point. They knew that, though we were among the earlier countries to set up common schools, many European countries were ahead of us. As late as 1929, 26 American States required 8 years or less schooling, 20 States 7 years or less, 2 States required 4 years, and 1 State 3. Most leading countries abroad required 8 or 9 years. I suppose the illusion comes from our greater familiarity with English than with continental education. It is true that we were ahead of England in establishing common elementary schools. But on the Continent, there are some countries that have had full public school systems since the 16th century—Württemberg, for instance, also the Swiss Canton of Vaud. Württemberg consequently had an illiteracy rate of only 0.02 percent among her army recruits as far back as the 1870's. Recently, our own Army disclosed that 25 percent of our draftees were unacceptable for mental reasons.

But if I showed that German education has features we might like to adapt to our own needs, the reply inevitably would be, "Do you want a Hitler?" Germany, I believe, has at the moment the largest number of types of secondary schools, so that children have a wide choice and every ability level can be given its appropriate curriculum, adjusted to the learning pace and capacity of the student.

Although I knew the educators would be in full cry after me for allegedly wanting "to set up a Communist school system in this country," I did write and speak about Russian education. The Russians have gone furthest in eliminating "ability to pay," which I take it is one of our own fundamental educational goals, and they have managed to motivate greater numbers of children to undertake and complete tough academic courses, which is surely our desire as well. This has earned me the sobriquet of "Russia lover" and "jackass" from the educators. But I don't mind, as long as I am able to help the American people to find out what our chief rival is doing in education.

I did hope they would be more willing to give consideration to my descriptions of Dutch and Swiss education. These are inoffensive small countries, modern and up to date, prosperous and in their way of life not too different from ours. The Swiss, besides, have the same problem we have with Federal versus State's rights in education and they are a very old democracy. While education there is managed locally, and the cantons—their name for states—have full charge of public education, the Swiss have managed to devise ways for setting up national scholastic standards, a problem we have not solved. We don't even recognize that we must set up such standards if we want to become educationally competitive with the rest of the civilized world.

THE COMMON EDUCATIONAL CHALLENGES OF ADVANCED NATIONS

I stress the word civilized. It annoys me when our educators smugly point out that we do better educationally than Outer Mongolia or some such outlandish place, and that many students from Africa or other undeveloped countries come to the United States to study. To my mind, we should compare ourselves only with the most educationally advanced countries of the world and try to equal or surpass them. Now Europe has had 700 years of experience with formal schooling. Our experience has been much briefer. We didn't produce our first doctorate until 1861. The first European doctorate is lost in the mists of history. She had universities as early as the 9th century and they began flourishing in the 11th and 12th. It seems to me eminently sensible that we should observe how this old

Continent goes about educating its children. Almost every European country does at least one thing in its school system exceptionally well. I see no reason why we should not take notice and adopt what is good in these school systems. Defenders of the status quo in American education always accuse me of wanting to foist this or that foreign system on our children. All I do is supply *information.* And I may mention I get no pleasure out of reporting that other countries have higher scholastic standards. But closing our eyes will not make the problem go away.

I think one can't stress too often that it makes sense to observe how countries at similar levels of culture and technology accomplish the technical task of transmitting basic knowledge and helping children to develop their intellectual powers. Surely the school must lead children to adult maturity in terms of what an adult person must know to function effectively in his particular society. Today most of our children—like most European children—are going to live in an urban environment where they will need alert and informed minds to succeed as persons, as breadwinners, and as democratic citizens with civic responsibilities.

BASIC EDUCATION VERSUS LIFE-ADJUSTMENT TRAINING

It is only through basic education that you are able to help children to develop alert and informed minds. Life-adjustment training will never do it. It turns the teacher into an entertainer and in this way makes him subject to his pupils' whims. We have to get back to recognizing that the teacher's function is to *instruct. The school is not a democratic community* where children have the democratic right to decide what they want to be taught. Yet this is what progressivism wants it to be. A teacher has authority by virtue of his superior knowledge and the fact that he is employed to transmit this knowledge to his pupils. It is downright silly for the progressives to deprecate this as "authoritarian" education. Their whole dogma of permissiveness has had the most unfortunate consequences. A few young hoodlums are allowed to disrupt class, and teachers are forbidden to discipline them or schools to dismiss them. Whenever an individual interferes with the good work of others he should be withdrawn from the school. He may be a social problem or some other kind of problem, but he is not a school problem.

With some notable exceptions, the educators have not had the courage to demand that troublemakers be separated from normal children so that the latter may go about the business of becoming educated. The educators themselves have often been confused by their preoccupation with making the schools primarily agencies for social equalization. They haven't liked to come right out and say that some children are such difficult disciplinary cases that it takes special institutions to deal with them. Their comprehensive school complex gets in the way.

But isn't it presumptuous, in the name of democratic education, to demand of parents who raise their own children with great care that they must let them associate with undisciplined or even criminally inclined children? I rarely see this problem discussed in American educationist writings. Abroad schools appear to have a more sympathetic understanding for the natural desire of conscientious parents to protect their sons and daughters against being influenced by children who for one reason or another, usually parental neglect, behave badly or criminally. A school should not be diverted from its own great constructive ends to picayune and sentimental side issues.

Our schoolmen claim their life-adjustment training will develop good character traits. They often alibi poor scholastic achievements by saying that our schools do better in character training. The sad fact is, however, that we have more juvenile delinquency and more adult crime and that both have risen in the past decades when the progressives held full sway over our schools. I would not personally want to blame the schools for this. But they can't have it both ways. If they counter criticism with their "whole child" education claim, they have only themselves to blame when critics remind them of rising crime rates.

Permissive schools cannot fully develop children's intellectual capacities. Only a person possessed of a disciplined mind has attained his maximum mental power. You learn intellectual self-discipline through basic education, not through life-adjustment training. If you leave it to children to decide whether they want to learn hard subjects or take easy courses, they will usually pick the easy ones. The permissiveness in our schools is another cause of their poor scholastic performance.

EDUCATION AND SUPPLY OF ENGINEERS AND TECHNICIANS IN THE U.S.S.R.

Mr. CANNON. Admiral Rickover, a surprising number of Members of the House and Senate have been schoolteachers at sometime in their lives. And we have in both Houses men who have been very successful as professors in colleges and universities. Also we have in the United States a great body of men who have devoted their lives to the study of pedagogy. But there are two things that give us some concern. One is that the Russians are graduating every year many more competent engineers. And that Russia has run rings around us, figuratively speaking, in space achievement and exploration. Can you give us more information on this, Admiral Rickover?

Admiral RICKOVER. The Russians have now for some years been graduating about three times as many engineers as we. According to the Engineer's Joint Council, they plan to step up this output by 35 percent during the next few years. By 1970 this will give them an engineering manpower pool of close to 2 million. Unless we drastically increase our own engineering output, we cannot expect to have much more than 1 million engineers by that time, or half the Russian total.

The quality of Russian engineering education is good. When a student receives his diploma he has had practical as well as theoretical training. He will be ahead of the average American engineering college graduate even after the latter has had 2 years of industrial experience. A delegation from the Engineer's Joint Council visited a number of Russian engineering colleges in 1960 and found the education they provided to be of high quality, with mathematical and theoretical content equal to or above that generally given in U.S.

engineering colleges. Russian engineers are particularly well trained in their engineering specialty.

Not only will Russia have twice as large a pool of engineers by 1970, these will also be able to do more effective work because they will be supported by a large body of engineering technicians.

Russia has an extensive educational program for every type of technician. Her technicums annually graduate 250,000 *engineering* technicians alone. In contrast we currently graduate only 16,000. A decade hence, the Russians will have a mammoth pool of engineering technicians—3½ million of them—to support their 2 million engineers. This means close to two technicians per engineer. We can at best hope to have 200,000 engineering technicians to support our 1 million engineers.

Russia intends to concentrate on producing engineers and technicians in order to obtain the talent she will need to outproduce us. She is bound to succeed if we remain complacent to this challenge and do nothing to meet it. She will produce so large an engineering manpower reservoir that she will have a surplus to supply underdeveloped countries with the technical help for which these countries clamor. Not a few of them may decide to accept Communist control in exchange for economic improvement.

As I said before, our shortage in professionals, technicians, and skilled labor is largely the fault of our schools. They do not lay a proper foundation in basic subjects during the years children can best acquire them. The prospect of being vastly outproduced in engineering manpower by the Russians is the price we have to pay for progressive insistence on practices that make it impossible for our schools to do their technical job well.

I would like to include tables of statistics pertaining to Soviet scientific and technical manpower in the record.

Mr. CANNON. The tables will be inserted in the record.

(The tables follow:)

TABLES OF STATISTICS PERTAINING TO SOVIET SCIENTIFIC AND TECHNICAL MANPOWER

Table I. Graduations from Soviet higher educational institutions in 1960.

Table II. Engineering graduations from Soviet higher educational institutions in 1960.

Table III. Annual graduations from higher educational institutions in scientific-technical fields, 1928–60.

Table IV. Total professional manpower in the U.S.S.R. in 1960 (graduates of higher educational institutions by general field in which education was received.)

Table V. Distribution of professional engineers in the U.S.S.R. by place of employment, 1955 and 1960.

Table VI. Total semiprofessional manpower in the U.S.S.R. in 1960 (graduates of specialized secondary schools).

Table VII. Number of individuals holding advanced degrees in the U.S.S.R. in 1960 (holders of *Kandidat* and *Doktor* degrees).

Table VIII. Soviet research and development personnel, 1955 and 1960.

Most of the figures in these tables are based on statistics from the Soviet statistical handbook, *Higher Education in the U.S.S.R.*, published in 1961 by the Central Statistical Administration, U.S.S.R. The figures for 1960 pertain to the last quarter of 1960.

TABLE I.—*Graduations from Soviet higher educational institutions in 1960*

In scientific and technical subjects:	
Physical sciences and mathematics	16, 600
Biological sciences	3, 000
Total in scientific fields	19, 600
Engineering (detail in table II)	107, 900
Agricultural engineering (irrigation, farm mechanization, etc.)	12, 200
Total in engineering	[1] 120, 100
Agriculture and forestry	22, 100
Health (mostly physicians)	27, 500
Total in all scientific and technical fields	189, 300
In subjects other than scientific and technical: Total graduations in humanities, social sciences, economics, law, pedagogy, and library sciences	152, 700
Total U.S.S.R. graduations from higher educational institutions in 1960	342, 000

[1] 121,000 in 1961.

TABLE II.—*Engineering graduations from Soviet higher educational institutions in 1960*

Geology and geological surveying	3, 898
Exploitation of mineral deposits	5, 246
Energy	8, 425
Metallurgy	3, 884
Machine and instrument construction	30, 408
Electric machine and instrument construction	8, 138
Radiotechnology and communications	6, 299
Chemical technology	5, 702
Forest engineering and the technology of lumber, cellulose, and paper	3, 724
Technology of food products	3, 396
Technology of consumer goods	3, 109
Construction	17, 760
Geodesy and cartography	612
Hydrology and meteorology	668
Transportation (operational)	6, 620
Total	107, 889
Engineering specialties in agriculture:	
Land development	826
Mechanization of the processes of agricultural production	6, 742
Electrification of the processes of agricultural production	1, 021
Irrigation and drainage	1, 330
Forest engineering	2, 324
Total	12, 243
Total engineers, of all types	120, 132

TABLE III.—*Annual graduations from higher educational institutions in scientific-technical fields, 1928–60*

[In thousands]

Year	U.S.S.R.	United States
1928	20. 8	33. 9
1929	21. 2	34. 3
1930	31. 6	34. 7
1931	34. 1	36. 3
1932	30. 5	38. 5
1933	18. 3	37. 6
1934	29. 0	37. 2
1935	55. 3	37. 6
1936	57. 6	38. 7
1937	61. 7	41. 3
1938	58. 2	44. 1
1939	56. 9	47. 3
1940	62. 9	50. 6
1941	59. 1	51. 2
1942	44. 9	52. 0
1943	23. 7	45. 9
1944	22. 7	41. 0
1945	23. 2	38. 8
1946	40. 2	42. 5
1947	50. 4	63. 6
1948	70. 1	82. 6
1949	79. 0	109. 1
1950	75. 4	133. 9
1951	83. 8	113. 0
1952	89. 5	92. 8
1953	86. 0	84. 0
1954	100. 2	79. 7
1955	114. 0	78. 8
1956	123. 6	82. 5
1957	142. 9	92. 0
1958	156. 0	101. 7
1959	173. 4	107. 1
1960	189. 3	111. 2

TABLE IV.—*Total professional manpower in the U.S.S.R. in 1960 (graduates of higher educational institutions by general field in which education was received)*

Engineering	1, 115, 000
Physical sciences and mathematics	124, 000
Biological sciences	24, 000
Medicine and pharmacy (including 400,000 physicians)	425, 000
Agriculture (agronomists, veterinarians, foresters, etc.)	264, 000
Total number with scientific or technical training	1, 952, 000
Professional manpower trained in education, law, economics, humanities, etc	1, 593, 000
Total Soviet professional manpower (with complete higher education)	3, 545, 000

TABLE V.—*Distribution of professional engineers in the U.S.S.R., by place of employment, 1955 and 1960*

Place of employment	1955	1960
Industrial, construction, transportation, communications and other organizations	290, 200	550, 300
Administrative organizations	65, 500	85, 900
Agricultural organizations	19, 900	18, 100
Educational institutions	53, 100	74, 600
Research and development organizations:		
Geological survey organizations	14, 700	32, 700
Developmental organizations (design bureaus, etc.)	87, 600	206, 300
Scientific institutions	54, 900	147, 600
Total R. & D. (engineers only)	157, 200	386, 600
Total	585, 900	1, 115, 500

TABLE VI.—*Total semiprofessional manpower in the U.S.S.R. in 1960 (graduates of specialized secondary schools)*

Educated in technical fields:	
"Technicians"	1, 931, 000
Agronomists, veterinarians, etc	381, 000
Medical workers (including dentists)	1, 187, 000
Total	3, 499, 000
Educated in other fields: Statistics, pedagogy, trade, library work, etc	1, 740, 000
Total number with specialized secondary education	5, 239, 000

TABLE VII.—*Number of individuals holding advanced degrees in the U.S.S.R. in 1960 (holders of Kandidat and Doktor degrees)*

Science and engineering:	
Engineering sciences	28, 000
Physical sciences and mathematics	18, 430
Biological sciences	7, 800
Medical and pharmaceutical sciences	18, 300
Agricultural sciences	8, 600
Total, science and engineering	81, 100
Social sciences and humanities	24, 900
Total number of individuals holding degrees of kandidat and doktor	106, 000

TABLE VIII.—*Soviet research and development personnel, 1955 and 1960*

	1955	1960
Scientists: [1]		
In higher educational institutions	75, 000	87, 000
In research insitutions	83, 000	172, 000
Professional scientific supporting personnel	20, 000	50, 000
Professional personnel in engineering-design activities	87, 000	208, 000
Professional geological survey personnel	15, 000	33, 000
Semiprofessional supporting personnel	100, 000	200, 000
Total	380, 000	750, 000

[1] The term "scientists" here corresponds to the category "scientific workers" used in Soviet statistics less those engaged in research and teaching in the social sciences and humanities. The totals given for this category in Soviet statistics, including social sciences and humanities, are for 1955, 223,893; for 1960, 354,158; and for 1961, 404,200.

NOTE.—The usefulness of this table is that it shows growth rates within the frame of reference of Soviet statistics. Individual categories cannot be defined clearly enough to warrant comparisons with U.S. figures.

Mr. CANNON. Admiral Rickover, Mr. Fogarty's subcommittee in the 87th Congress had before it Mr. McMurrin, the Commissioner of Education. I must confess I am astonished on reading his testimony to find that he largely agrees with you.

Admiral RICKOVER. Yes he does. I must say I am encouraged when I read what he says. He recently wrote an article in which he raised all the points about American education that have been worrying me. It's been like a breath of fresh air. The only trouble is that he has this entrenched bureaucracy to deal with.

THE DIFFICULTY OF EFFECTING SCHOOL REFORM IN THE UNITED STATES

As I said, school reforms have had to be undertaken in many countries. So that's nothing new. But I don't know of any country where it is so difficult to make a change as in ours where we have this enormous educational establishment. It's no use blinking at the fact that the people who run this establishment have committed themselves repeatedly and volubly to progressive education. They have a vested interest in it. In many cases it is the only kind of education they know or they can handle. And then there are all sorts of other people with a vested interest in the status quo—the National Education Association; school administrators who have never taught a class and who aren't teachers; who wouldn't have their jobs if we copied the European system of putting well-educated and qualified teachers in charge of the school system and giving them whatever clerical help they need. Then there are the coaches with a vested interest in continuing athletic spectacles; the textbook publishers with a vested interest in the look-say method of teaching to read. And I suppose once we commit ourselves to machine teaching, the manufacturers of these machines will achieve such a strong vested interest that we shall never be able to reinstate the teacher, even if we should discover that machine teaching isn't as good as teaching by a live human. I am afraid Mr. McMurrin may not stay long enough on the job to make his viewpoint strongly felt.

This is one of our troubles. We shift people around too much. We seem to think that a person who has held one administrative position can instantly step into any other administrative position and do useful work. But today all really important jobs require that persons in authority first acquaint themselves with their particular responsibilities and then stay on long enough to put this competence to use. As it is, the men in command of our huge Government bureaucracies wander in and out of top positions, rarely staying long enough to make their nominal command truly effective. To be effective a leader must understand the technical work of the organization he heads. This is where the British have had a great advantage in their efforts to improve public education. From the start, the men who headed the central education authority in London were the very ones who had long agitated for school reform and who were personally involved in getting Parliament to enact the requisite laws. And these people stayed on the job for long periods of time so that they really were able to accomplish something. We don't do that.

We have the same trouble in the Navy. Officers are shifted in and out of the most complex technical jobs every 2 or 3 years. Just about the time they get the hang of a particular job, they are transferred. The idea back of this is to alternate tours of sea duty and shore duty and also to give officers experience with every type of naval duty so they can become versatile. This may have worked in the past when such versatility had to do with what might be called the strictly naval qualifications of the naval officer; that is, when this versatility did not have to include competence to direct highly technical scientific and engineering work.

Today design and construction of nuclear ships as well as the design of modern weapons, such as missiles, has become so complex and difficult a job that to allow technically untrained officers to exercise authority over this work during brief tours of duty must lead to inefficiency and sometimes to extremely serious errors.

Even the operation of modern warships becomes daily more of a technical job. These ships now are comparable to our most advanced industrial plants. To run them is essentially an engineering rather than a naval job. Even their use in naval combat now requires scientific and engineering skill rather than the skills of a professional naval officer. Theoretically, a competent team from General Electric or Westinghouse could operate a nuclear submarine or launch a missile. In fact, the important and difficult aspects of missile launchings are now in civilian hands. On the other hand, a naval officer cannot, without extensive training, take charge of a nuclear ship. Without this training it is doubtful he would be competent to make wise decisions as to how best to use these entirely new types of warships, how to operate them to assure maximum safety, or whether it is expedient for these ships to enter foreign ports. Untrained officers do not seem to realize the disastrous consequences that might follow wrong decisions made by persons who do not fully comprehend the danger potential of nuclear power.

I mention this by way of illustration that we can no longer assume, as we did in the past, that *anybody* can do *anything*. This was part of the Jacksonian creed. Indeed, in pioneer days Americans were jacks-of-all-trades and remarkably skillful in most. But today the requirements have risen. It would seem advisable that we take account of this fact and manage our public business so as to give people in authority a chance not only to become competent on the job but also to make full use of this new-won competence before being moved to another position.

I hope Mr. McMurrin will stay on long enough to get his ideas translated into practice. But, in any event, it is encouraging that for the first time in many decades there is someone at the head of the Office of Education who does not have the National Education Association viewpoint. I should like to take this as a sign that at long last we are beginning to throw off the incubus of progressivism and that we shall now get busy undoing the errors of the progressives that have done so much harm to our children and to our Nation.

It has been said that it takes 50 years for half the educators to adopt a manifestly good new idea. But today we don't have 50 years tolerance and I hope Mr. McMurrin can help to reduce this time drastically.

Mr. CANNON. We have reason to be concerned about our system of education. The future of our country and the future of the world rests on the way in which we train the next generation.

For instance, I notice you said just now, and I notice that Commissioner McMurrin said:

> The quality of teaching generally is lower by far than it should be and lower too than it need be. It is here that we confront our greatest failure in matters pertaining to education.

Then you said a while ago, and he said in corroboration:

> In the future every effort must be made to identify persons of highest intellectual competence and talent in the art of teaching and to attract them to the teaching profession, and standards of our colleges and education must be made to exclude those who do not have real promise.

Commissioner McMurrin is at the head officially, as far as the Government is concerned, of our educational system, and he seems to agree with your criticism.

ASPECTS OF ENGLISH EDUCATION WHICH SHOULD BE STUDIED

EFFICIENT UTILIZATION OF TIME AND MONEY

Now, you have been studying this for 2 years. What is there in the English system we could adopt with profit?

Admiral RICKOVER. I will be glad to answer that, sir.

There are several aspects of English education I believe could be profitably studied by us. *First*, the efficiency of her present-day school system in terms of utilization of time and money. As I said before, in this respect English education is not quite as advanced as education in some continental countries but it is closer to ours, so we might find it easier to adopt some of her practices. English children of all aptitudes move ahead faster than our children and, therefore, complete their school courses earlier. In view of the population pressure on our teacher resources and school facilities it is highly advisable that we give consideration to England's more efficient way of doing the education job.

As on the Continent, English schools concentrate on *basic* education, leaving other aspects of education to home, church, and community. They do, however, put somewhat more stress than some continental school systems on developing the pupil's character and his physical fitness. This also brings them closer to our own educational goals. Unlike our schools, however, the English do not treat character development as a course subject. They seek to develop good traits through the vehicle of academic subjects.

As for developing physical fitness, their program is concerned with the physical improvement of *every* schoolchild and with transmitting to each of them a sense of fairplay through participation in competitive sports and games. There are the usual intramural and interschool sports that are also a feature of present-day continental schools. England pioneered these. These competitions are exclusively for the benefit of the children. They are wholly amateur in character. The schools do not stage semiprofessional athletic spectacles for the entertainment of grownups. They have no coaches whose chief responsibility is to train star athletics and win sports shows. Students do not gain admittance to a school or college because of athletic ability, as is unfortunately sometimes the case in our country. There are no athletic scholarships; no one goes about the land recruiting promising young men for the football squad as do many of our colleges, and of course Annapolis, West Point, and the Air Force Academy. Schools do not depend on winning games in order to obtain adult approval and to induce alumni to make money donations.

They do not choose school heads for their skill in collecting funds to keep the institutions going. No school or university has public relations staffs. Indeed, the very idea seems preposterous to the English as to Europeans in general. The financial precariousness of higher education in our country is virtually unknown abroad.

DEVELOPMENT OF ENGLISH PUBLIC SCHOOL SYSTEM

A *second* aspect of English education of interest to us is the way her present-day public school system came into being. It is useful for us to become familiar with this because a century ago the English were under outside pressure to upgrade education, quite similar to the pressure on us today. They responded to that pressure then much as we do today. We can learn from English educational history what *not* to do, for England was slow to bring her school system up to the scholastic levels of schools in countries on the Continent with whom she was competing economically and politically. From first proposal to final enactment of parliamentary legislation, it took the British 50 years to set up a tax-supported elementary school system, and nearly 100 years to provide tax-supported secondary education. She was in both cases more than a century behind her chief continental rival, Prussia.

I greatly doubt we will be allowed that much time to bring ourselves educationally up to par with our chief rivals—the totalitarians and the new united Europe.

MAINTENANCE OF NATIONAL SCHOLASTIC STANDARDS WITHOUT LOSS OF LOCAL CONTROL

A *third* feature of English education that has relevance for us are the techniques she has evolved for raising scholastic achievement levels nationally while leaving the management of public education under local control. Or, to put it differently, we can learn from England how she maintains national scholastic standards while permitting schoolteachers, local authorities, and universities the widest freedom in running their affairs. Now, as I see it, this combination of freedom with standards of excellence is the most pressing of our educational problems. For this reason we should be eager to find out how it is solved elsewhere. In my book *Swiss Schools and Ours*, I describe how it is done in Switzerland, which has the same federal form of government as we.

I would now like to describe how it is done in England—a unitary state that does not have our Federal versus States rights problem, but does share our desire to allow local communities the utmost liberty in educational matters.

The Swiss and the English have had much experience with self-government. They also have great political skill. So have we. We could solve this problem just as well, if only we recognized the *necessity* for doing so. Although innumerable studies, public hearings, and so on have brought out the need for action, we simply keep on going through the motions, debating the issue over and over again while taking no really effective action. We have been treading water for years. The same things are said over and over again. The same people appear before Congress taking up a lot of your time, repeating the same arguments, submitting the same facts. The same case is made by those urging reform—like myself—and by those opposing reform who use the same old cliches of "Federal tyranny" and the glory of local control of American education.

Just so did England procrastinate a century ago. In her case it was a battle over church versus state control, combined with a private versus public education controversy, that prevented necessary and timely action. As we observe English dilatoriness and the consequences to her of postponement of needed school reforms, we may recognize the danger to us of our own inaction if we don't get on with the job. We haven't any time to lose.

THE EDUCATION SYSTEM IN ENGLAND AND WALES

Mr. Cannon. That is a matter of particular interest. Could you explain in a little more detail?

Admiral Rickover. I will be glad to, sir. I will describe in main outline how English children get educated today. I shall confine my description to England and Wales which comprise the bulk of English children. Northern Ireland and Scotland have somewhat different school systems and there isn't time to go into them here.

The total population of England and Wales is 45 million, slightly less than one quarter the population of the United States. It is packed into an area the size of Connecticut, New York, and New Jersey. Overall, Britain has about 1 acre per person compared to almost 11 acres per person in the United States. English agriculture is highly efficient, 80 percent of total land area being farmed or used for pasture and rough grazing, but she cannot feed herself and has to depend on food imports. In mineral and fuel resources Britain is very poor compared to us and to some continental countries. These facts must be kept in mind when comparing American and English education statistics.

PRIMARY AND JUNIOR GRADES

Schooling is obligatory for 10 years—from ages 5 to 15. It is free to age 19 in the state system, in which 94 percent of England's children are enrolled. Only 6 percent are in private schools receiving no tax support. Children attend primary school for 6 years or until the fall of the year in which they have reached age 11. Education is comprehensive during the primary stage. Children usually stay 2 years in an infant's and 4 in a junior school; sometimes the two are combined. Five-year olds get into solid work immediately, doing much reading, writing, and arithmetic every day. In large schools they are "streamed," that is grouped by ability. The school year is divided into three equal trimesters separated by vacations. This makes it easier to let the very bright accelerate since they can do it a third of a school year at a time. Acceleration is more common in private than in state schools.

Primary schools are usually housed in sunny pleasant buildings. The atmosphere in school is friendly and relaxed yet the children move ahead at a fast pace and by age 11 are usually 1 to 2 years ahead of American children who have completed the sixth grade. And this despite the fact that English children are a year younger, having begun schooling at 5 while in this country it is usual to start at 6. They are ahead because the school has concentrated on *basic* education, the teaching has been skillful, and the need to study is more clearly understood by the children and their parents. It is better understood at least in part because primary school ends with an examination that will determine what kind of secondary education each child is to receive. Finally, there is about 20 percent more class instruction in a given English school year.

PRIMARY SCHOOL CURRICULUM

The schoolday lasts from 9 to 4 with time out for lunch. Incidentally, England has since 1906 had school lunches at nominal cost, and free for those unable to pay. Medical care goes back to 1907. The primary school curriculum is so arranged that children devote the biggest block of class time to study of the English language—7 to 10 hours per week. The less able get more instruction to help them keep pace with the more able. Arithmetic and geometry—in some schools some slightly higher mathematics also—take up roughly 3½ to 4 hours a week; about 1 hour each goes to nondenominational religious instruction, to history, to nature study, and to geography. Art, music, and some craftwork take 2 hours, and every day there is some form of physical education, with or without apparatus, some swimming, dancing or games.

As regards mastery of the English language, all but a small percentage of English children will be reading well by age 10 or 11. During the last 2 years in primary school, children will be doing compositions. By 11, as one official handbook puts it, they will "know that conventional spelling is a necessary civilized convenience." I know American college students who have not yet grasped this simple truth.

An interesting comparison of arithmetic achievements here and abroad is made in a booklet by the Council for Basic Education, entitled "Teaching the Third 'R.' " This divides arithmetic into 12 separate "study units," such as "multiplying whole numbers by decimals" or "percentages." By means of textbook comparisons it then shows when these several units are begun and completed. We find that of these 12 units only 2 are studied in England in the same grade as in this country, 6 are studied 1 grade earlier, 2 are studied 1½ grades earlier, 2 are studied 2 grades earlier. Lest we think this is some particular English virtue, let me hasten to tell you that in France children are 2 years ahead of us in *six* units, 1½ years in 2, and 1 year in 2. Incidentally, I notice in Max Raeff's "Report on Russia's Big Red Schoolhouse," an algebraic problem that is studied by Leningrad fourth graders but which usually occurs for the first time in American eighth grade textbooks.

Mind you, this is in the state system, in common or comprehensive schools attended by children with aptitudes through the full range from slow to bright. We have no excuse for teaching our children so badly that they are behind English and continental children at this early age. And just in case it is objected that the health of England's children will be ruined by all that studying let me mention that in a number of comparative studies on physical fitness, English—and other European—children consistently outdid our own pampered children.

THE HAMPERING OF U.S. SCHOOLS BY "PROGRESSIVE" EXPERIMENTERS

Since English primary education is carried on in comprehensive schools, we could easily, if we wished, set ourselves the goal to match her achievement levels at age 11, at least for our 12-year-olds. There is nothing in English primary school objectives or practices that would go counter to our own educational philosophy. We would merely need to lengthen the school day and year somewhat, make certain all our children receive a full day's schooling—we still have some areas where the schools are on double shifts—require of our teachers better subject mastery, and jettison "look-say," "reading-readiness," and the whole nonsense of progressivism and life adjustment. The last item is the most important one. If our teachers are to succeed in bringing normal children to the point of literacy and—to use an English expression—numeracy, both of which are achieved by normal English children in 6 school years, they must be freed from the incubus of the experimenters and the so-called scientific researchers who produce all the notions that prevent our schools from doing their technical task.

The intellectual and educational qualifications of most of these experimenters and researchers are unimpressive but, on the strength of having majored in sociology or psychology at a teachers college, they consider themselves qualified to research the American child and lecture the American teacher and parent on the "learning process." These "researchers" have an aura of precision about them—a satisfied certainty of having the right answer—yet their theories are never quite the same for 2 years in a row.

As one teacher remarked who finally quit in disgust:

> One year it was bundles of wooden sticks and red and blue poker chips—millions of them—to replace the multiplication table and give the children a sense of learning by doing. Another year it was a series of readers, so arranged that children could be taught to read without the boring and unlifelike process of learning the alphabet. Yet again it would be a revised social studies curriculum, according to which students were to spend weeks on "orientation to school," "my family," and "our neighborhood," while ancient history was resolutely dropped from the course of studies altogether.

Sociology and psychology, in the hands of intelligent, well qualified professional persons, can be of great benefit. But indiscriminately applied by unqualified people it can do great harm. And much of the educational "research" in this country has been harmful. I have shelves of books and pamphlets in my library, filled with the outpourings of educational researchers. As I force myself to read through page after page of muddled thinking and murky writing, two thoughts are uppermost in my mind. Regret that so many trees had to be felled to produce the paper on which the stuff is printed; how much better off we should be if we still had the trees! And a strong desire to cry out, "Won't someone stay home and keep shop? Won't someone stay in class and teach our children the fundamental skills of the three 'R's' "?

We are plagued with a chronic shortage of teachers, but we have an overabundance of researchers. For some odd reason educational "research" seems to bestow a higher status than teaching. And so the classrooms get more crowded but the "research" just goes on and on.

It always amazes me that our educational officialdom looks down on Europe's allegedly outmoded teaching methods—"rote" teaching is the stereotyped epithet that educationists use—even though the schools abroad are so much more successful in getting children through a given study course. Consider the recent report of a conference of reading experts who spent the winter of 1961 on a "project" financed by the Carnegie Corp. and intended to dispel the "confusion" in the public mind as to methods of reading instruction used in our schools. Unwittingly the report acknowledges that the simple task of teaching children to read is just too difficult for our schools to accomplish in 12 short years. Twenty-seven of the twenty-eight education professors and administrators participating in the project concluded that "reading instruction is needed beyond the high school!" As Oliver Wendell Holmes said:

> At this time we need education in the obvious rather than investigation of the obscure.

American educators now sometimes admit that European children do move faster, but they still criticize European schools for allegedly paying no attention to modern sociology and psychology. To my mind, the proof of the pudding is in the eating. Our wonderful "scientific" and up-to-date teaching methods produce inferior results, so why continue them? And as to the constant accusation that European schools go in for "rote" learning—the truth is quite the opposite—there is more rote learning here.

That disastrous progressive blunder, the "look-say" method of teaching our language—as if it were a language of single-word Egyptian hieroglyphics or Chinese characters—is nothing but one vast boring system of rote learning with the children being made to read endlessly repeated idiocies such as "Oh, oh! Come, come! Look, look!" just to learn three simple words. No one has brought out the absurdity of this system so well as Rudolph Flesch in *Why Johnny Can't Read*. And now we have a book by the Council for Basic Education, *Tomorrow's Illiterates*, that spells out in terms of massive inability to read among large percentages of our youth just where this ridiculous progressive method has taken our children. Another progressive error, the "reading readiness" dogma, postpones and postpones the moment when an American child finally comes to grip with the printed word. His English cousin has meanwhile happily gone ahead learning to read at age 5 and nothing has happened to his tender psyche.

In arithmetic, too, the readiness dogma holds our children back while the teaching itself is inferior since our elementary schoolteachers, with few exceptions, are less well trained to teach the subject than English or continental teachers. Arithmetic is particularly well taught in England. An observant American visitor will note how quick everyone is in handling the complicated English monetary system. In contrast clerks in American stores have quite a time of it if they have to figure something out themselves. Without adding machines many of them would be lost. Great emphasis is laid abroad on mental concentration in computation processes, on careful development of basic number concepts, and on constant daily exercises and frequent tests. Virtually all European children acquire mastery in arithmetic and geometry in less time than do ours.

That primary school reform is possible in this country and would not take overlong to accomplish is proved by the ease and speed with which Dr. Hansen has been able to set up the Amidon Elementary School right here in Washington. This school has been a great success and is to become the model for elementary education in this city. It is the kind of school Europe has had for a long time but which our educationists have consistently criticized as archaic, fossilized, obsolete, and what have you. The same epithets are currently being launched at the Amidon School by unreconstructed progressives. But I think their day is coming to an end. All they can do is continue to throw up roadblocks and delay the inevitable. Given the importance of speedy reform for our Nation's future, they might however just succeed in causing enough delay to do serious harm to the country. I feel we have given them enough time to prove their theories. These theories aren't working, so let's throw them out and get on with the job of truly educating our children.

To recapitulate: English primary schools give children a better foundation in the elementary subjects so that all of them are ahead of American children of equal ability when they begin secondary schooling at age 11.

TYPES OF ENGLISH SECONDARY SCHOOLS

At this point their paths diverge. On the strength of their school record, of an IQ test, and written examinations in English and arithmetic, children are placed in one of the three types of secondary schools: Grammar School, Technical School or Secondary Modern School. The first two are "selective," that is, to be admitted children must have the ability to pursue a rigorous academic program. *We have no* *secondary schools equivalent to either the English Grammar or Technical School.* Their Secondary Modern School, however, resembles our high school in that it is an unselective school catering to a rather broad range of ability levels. It differs from our high school in that the top 30 percent of the ability range is absent from among its pupils since they are attending the Grammar School or the Technical School. Secondary Modern pupils usually range from IQ 110 down to about IQ 80. There are special schools in England for those below IQ 80; these are called "educationally subnormal" or ESN.

METHOD OF ASSIGNMENT TO SECONDARY SCHOOLS

For England as a whole about 25 percent of 11-year-olds are placed in Grammar, 5 percent in Technical Schools. These are overall percentages, and there are local variations. Assignment to a given type of secondary school is the responsibility of the Local Education Authorities. In some localities Grammar or Technical School places are scarce and talent is abundant, while the reverse will be true in other areas. This creates geographic inequalities in the selection process. Some children cannot get into Grammar School even though they have the requisite ability; others get in who would fit better into Secondary Modern.

Such inequalities are contrary to the intent of the 1944 Education Act which stipulates that placement in secondary school is to be entirely a matter of what is "appropriate to children's capacities." Under the terms of the act, the local education authorities are obligated to provide secondary schools—

> sufficient in number, character, and equipment to afford for all pupils opportunities of education offering such variety of instruction and training as may be desirable, in view of their different ages, abilities, and aptitudes, and of the different periods for which they may be expected to remain at school.

Not all Local Education Authorities, by any means, have been able to carry out their obligation to provide "sufficient numbers" of the required secondary schools or to equip and staff all of them adequately, though not for want of effort. The postwar years have been difficult for England. Despite heavy taxation, public funds have been inadequate to finance the many pressing needs that had to be taken care of. Extensive war damage has had to be repaired. A variety of new public services demanded by the electorate have had to be provided. There has been too much to do and too little to do it with. In education, sudden expansion always creates a scarcity of places in the higher schools because the kind of teachers needed to staff them cannot be produced overnight. Moreover, many planned improvements have had to be postponed to take care of England's unexpected postwar baby boom. Money and effort that was to have been put into raising the quality of education had to be spent on providing additional classrooms and teachers to take care of what the English call the "bulge." But with population growth back to normal, it will now be possible to build and equip more grammar schools and raise Secondary Modern School standards.

The English school system should be judged by its overall plan, not by temporary shortcomings which the English are doing their best to overcome as speedily as possible. When their plan has been fully put into effect, placement in a given secondary school will be by ability alone. And each type of secondary school will be fully developed to serve the particular education needs of its pupils. As stated in a recent official Ministry of Education release, all schools—

> will have the advantages and the amenities hitherto exclusively associated with the limited number of schools called secondary schools up to 1944. They will have equally good buildings. They will enjoy the same holidays and play the same games. In all the schools the studies will be related to the abilities and aptitudes of the pupils. The maximum size of classes will be the same for all. As a mere matter of finance, it will, broadly speaking, cost as much to build, equip, and staff one type of secondary school as another.

The only difference remaining will of course be the one intractable difference that is caused by differing human intellectual endowments.

It is just this difference that parents often cannot bring themselves to face. Separation of children into three different types of secondary schools disappointed many people in England who had believed implicitly what some politicians had promised: That the new education act would provide "a free grammar education" for "every English child." The act used the expression "secondary education," not "grammar education" but, since at that time the only secondary school was the grammar school, many people were misled.

To persons who themselves possessed only an elementary education, the Grammar School appeared to be simply a school for the rich. They were not educated enough to understand that ability to pay fees never had guaranteed anyone a higher education unless he was also able and willing to keep up with the school's study program. They did not realize that a grammar education had prestige not because it cost money but because it was difficult to absorb and because it led to university entrance. Admit all children to Grammar School and it would simply become a Secondary Modern School parading under a misleading name. But this was not understood.

The Lancashire Education Committee noted that to many people the new act meant "there would follow a miraculous transformation of the old elementary school pupils, so that their abilities and achievements would equal those of the grammar school child in the same fields of effort." Instead, the majority of England's children found themselves in the new Secondary Modern School upon which everyone at first looked with great mistrust. Fortunately, by the truly heroic efforts of England's devoted teachers, the Secondary Modern Schools have become very respectable schools, indeed, where good serious work is being done and standards are rising. Many of these schools are now housed in attractive buildings with playgrounds and all the special features English children and parents associate with a grammar education. It now happens occasionally that placement in a Grammar School is rejected in favor of placement in a Secondary Modern School.

Mr. CANNON. Admiral Rickover, could you give us some idea as to what is taught and accomplished in these three types of English secondary schools?

Admiral RICKOVER. I was just getting to this, sir. I would like to confine myself to the Grammar and the Secondary Modern School, leaving out the technical school which, as I said, has an academic program but with emphasis on mathematics and science and with a more practical approach than the Grammar School.

THE ENGLISH GRAMMAR SCHOOL SYSTEM

The English Grammar School has six forms, form being the English term for grade. During the first 5 years pupils study a wide range of subjects and there is little choice in programming. Toward the end of the third or the start of the fourth form, children usually begin to show preference or talent for one of the two major Grammar School courses: classics or modern. These are traditional terms and should be understood as indicating a linguistic-literary course and a mathematics-science course. I should add that a Grammar School "modernside" or mathematics-science course will differ from a technical school course in being more theoretical and hence more likely to produce research scientists, while the Technical School is more likely to produce engineers. This is the difference. On the Continent, incidentally, they have at least three different types of academic secondary school—"classical," "semiclassical or modern language," and "mathematics-science."

In the fourth form then, a child's program will be weighted somewhat on the side of his preferred subject but he will still take a broad range of subjects. At the end of the fifth form, at age 15–16, most Grammar School students will take an external examination in all subjects they have studied, the General Certificate of Education examination "ordinary" level, popularly called the GCE "O" level. Many students will end their general education at this point and enter a specialized school preparing for a profession or semiprofession or go to work. The English traditionally attend school for a shorter length of time than the continentals where children of similar aptitude and family background would normally continue at school to age 18.

Even in the private Grammer Schools, the so-called "public schools," such as Eton, Harrow, and so forth, only 33 percent of fifth formers will, on the average remain at school. These are England's richest, most privileged youth. They obviously drop out because they want to, not because they cannot afford to stay on. I think this will change, for in all countries there is today a great need for broadly educated people, and certainly the level of general education reached in the GCE "O" level is not as good as that reached by continental students who take the baccalaureat at age 18 to 19.

The schoolwork at Grammar School is divided into 35 class periods of about 40 minutes each. Twenty-seven of the periods are devoted entirely to academic subjects; the rest to music, art, religious instruction, and physical education. First formers will continue geometry which they have already studied in Primary School and they will start algebra. In the second, at latest the third form trigonometry is added. By age 15 those who lean toward the "modernside" will be well into calculus and coordinate geometry. Usually they will also have studied two foreign languages, the first begun at age 11, the second at 12. On the other hand, students with language preference may have added a third foreign language at age 13 but will not as a rule have gone as far as calculus.

All pupils study physics, chemistry, biology, history, and geography as separate subjects for several years, and carry these well beyond what is customary even in an honors high school program here. English and English literature are studied intensively. In foreign languages, incidentally, the private Grammar Schools, the so-called "public" schools, such as Eton, Winchester, etc., are ahead of the state system. To be admitted into these private schools children must, at age 13, pass a very tough entrance examination. They will be tested in two foreign languages which they will have begun at ages 8 and 9, respectively.

GENERAL CERTIFICATE OF EDUCATION (GCE) EXAMINATION

It is easy to judge what students learn in Grammar School, since almost all of them take the General Certificate of Education examination. This examination is administered by university-connected bodies and comes at three levels: ordinary, advanced, and scholarship. The ordinary examination is normally taken at age 15–16, after completion of the fifth form; the other two at age 17–18, after completion of 2, sometimes 3, years in the sixth form. May I request permission to include samples of these examinations in the record?

Mr. Cannon. They will be included.

(The matter referred to is included as Annex 1.)

THE GCE EXAMINATIONS AND OUR COLLEGE BOARD EXAMINATIONS

Mr. Cannon. How would these GCE examinations compare with those submitted by our college boards?

Admiral Rickover. It is difficult to make a comparison. The level of the English GCE can be easily ascertained by studying the types of examination problems students must solve to obtain what the English call a "pass" in a given subject. No information is available in the United States on how many of the students who take college boards actually pass their tests. Results are given in percentiles which merely indicate where a student stands among those who took the test along with him. Recently it was widely reported that 70 percent of our colleges and universities now find it necessary to set up remedial courses in English, 150,000 freshmen having, so it is said, failed college entrance tests in English. It is not clear whether by "college entrance test" is meant the College Board English Achievement Test, taken last year by 204,000 students. I hope not. That would be a deplorable state of affairs.

It would be interesting to have the College Board Testing Service make a careful comparison of the GCE "ordinary" level and the college board achievement tests in the major academic subjects. Of course, only about a third of those who take college boards take achievement tests, the rest merely take aptitude tests and these do not measure what students have achieved in the subjects taken at school.

Now the GCE is a written essay type achievement test which measures rather accurately what the student has learned about the particular subject in which he is tested and how good he is at applying his knowledge to the solution of test problems. College Board Achievement Tests allot 1 hour to each subject, English GCE "ordinary" level tests allot 2½ to 3 hours. Normally, a Grammar School fifth former will take at least five to six subject tests while the American will take only three. A GCE of only three "passes" is a poor showing for a Grammar School student; only about 19 percent do that badly. About 60 percent enter and pass a GCE in the whole range of subjects.

English or English literature are compulsory for the GCE. Favorite combinations are English, mathematics, physics, chemistry, biology, history, perhaps also geography or French. Or the combinations may be history, geography, mathematics, French, Latin, Greek, English language and literature. Students who stay on in the sixth form and later take the advanced and scholarship GCE, reserve their specialist subjects for that examination and take the ordinary level exam in the subjects they will no longer study in the sixth form.

I should perhaps mention that in recent years some of the abler Secondary Modern School children who stay on through the fifth form have been entering for the GCE ordinary exam and have obtained up to three "passes." Entering for the GCE "O" level exam is today no longer an exclusively Grammar School achievement.

To answer your question, I should say that a good GCE at ordinary level, taken at age 15–16, represents a higher scholastic achievement than an American College Board Achievement Test, taken at age 18. I have done some research to find out how many Americans take these easier tests, as compared to English children. Taking the year 1958, for which I happen to have complete information, this is the picture:

Of 2.9 million American children enrolled in the first grade 12 years earlier, in 1946, only 1.45 million graduated from high school in 1958. Of these, somewhat less than half entered some sort of college; official figures vary between 685,000 and 781,000, probably because the term "college" is variously defined. The college aptitude test was taken by 240,000, the achievement test in three subjects by 115,000. Only the latter can be compared with the English GCE ordinary level examination. These 115,000 are 5 percent of the age group.

According to official figures 26.5 percent of the English 15-year-old age group are in the fifth form of a selective secondary school, that is, a Grammar or Technical School in the state system or a private academic secondary school. Approximately 60 percent pass the full course of GCE subjects in the ordinary level examination at age 15 to 16. This is roughly 16 percent compared to our 5 percent of the age group. England, it must always be remembered, has only a little under one quarter as many people as we. In the last few years the number of Americans taking achievement tests has increased, but so has the number of English children taking the GCE exam.

We do not know, of course, how many more young Americans could have successfully completed the College Board Achievement Test. We can only go by the number who did take it. Also, there are other tests that may be comparable to the GCE. Still, it is clear that fewer American 18-year-olds complete the kind of academic education that would be required to pass the GCE ordinary level examination, which is taken by English children at age 15–16. And this, to my mind, is proof that our bright youngsters do not receive nearly as good an education in our comprehensive school system as English bright children receive in their Grammar School.

Now as to comparing the GCE advanced and scholarship level examinations with some American test, we shall have to reach up to our bachelor's degree to find rough equivalence. The evidence seems to indicate that the higher GCE is a degree either equal to or only slightly below the average American bachelor's degree. To get an idea of what it stands for, I will describe the sixth form of the Grammar School.

SIXTH FORM UNIQUELY ENGLISH

It is uniquely English. Nothing quite like it exists either on the Continent or in this country. The student who enters the sixth form has finished his general education, taken a good GCE ordinary level examination and intends to enter a university and prepare for a "learned" profession, or for a career in the higher echelons of the civil service or in politics. He is a bright person with a marked interest in his "special" subjects. He will devote two-thirds of his classtime and all his homework to two or three subjects upon which he will probably base his lifework and which he will continue studying at the university. He will have a pronounced talent for these subjects. Most of his fellow students will have left at the end of the fifth form. Classes will now be very small and contacts between teacher and student will be on a wholly adult level approaching a tutorial.

A tremendous amount of fine work is done under these conditions. Students will reach a level of achievement in their specialities that compares favorably to that of an American student in his college "major." This is particularly so when a student has accelerated during the first five forms in order to be able to stay in the sixth form for 3, instead of 2 years. A number of students do this.

THE GCE ADVANCED LEVEL EXAMINATION AND THE CONTINENTAL BACCALAUREAT EXAMINATIONS

At about 18, sixth formers take the GCE advanced level examination in their special subjects; in many cases they take the scholarship level examination as well. Since 80 percent of English university students are on scholarship and three quarters work for an honor's degree, what they call a "good" advanced GCE will be a tough proposition. For example, it may consist of two to three "A" and one or two "S" passes. A student intending to choose a scientific career, the so-called modernside, may take "A" papers in mathematics, physics, and chemistry, and "S" papers in one or two of these same subjects. He will of course have already taken a "good" "ordinary" level GCE at 15–16, sometimes as early as 14 if his school principal gave permission. That will mean five to six "passes" in other academic subjects. I doubt many American bachelor's degree holders have acquired so solid an academic achievement. Samples of "O," "A," and "S" level GCE exams are given in the annex to this report.

It may interest you how the GCE advanced level compares with the continental baccalaureat or maturity diploma which is usually acquired at about the same age or half a year later. The continental school year is longer than the English school year so that continental children will have had as much as a full year more of class instruction by 18. Naturally, the examinations they take for the baccalaureat will represent a somewhat higher scholastic achievement level. They will have been examined in eight or nine academic subjects. In my book *Swiss Schools and Ours*, I include numerous examination papers for the Swiss baccalaureat or maturity degree, as well as for an academic secondary school curriculum. I should evaluate the Swiss examination *in each subject* as at a level intermediate between the English ordinary and advanced GCE. The English student knows a good deal more in his *two* or *three special* subjects, but is less well educated *in general* than the Swiss. I am told this is pretty much the case with other continental baccalaureats.

The French degree—admittedly the most difficult on the Continent—appears however to be at or close to "A" level in most of the *eight* required examination subjects. In his excellent comparative study called *Other Schools and Ours*, Edmund J. King remarks that for a French student to pass his examination in English—a foreign language to him—he will have had to "cover as many authors and to answer questions just as difficult as an English child must when presenting himself for the 'advanced level' of the General Certificate of Education * * * in his *own* language. In fact, the French *baccalaureat* looks slightly more difficult." I may add that it looks more difficult than comprehensive examinations for even the best American bachelor's degree taken at about age 22.

I quote Mr. King who is an Englishman and not inclined to run down his own country's school system. Someone will surely say, Where did all this education get the French? Well, education is an intellectual matter and intellectually I think the French do stand high. France, incidentally, is one of the few modern countries having an excess of university trained people—despite these tough baccalaureat standards. Her rate of industrial growth has been so high in recent years—much higher than England's and much higher than ours—that even as I say this, her professionals may have all been absorbed in a booming economy. Things are happening very fast in Europe these days.

Because he starts his university studies so much better prepared, an English student working for his first degree will be doing graduate work largely. A university honor's degree taken in subjects in which the student has specialized all through the sixth form will cover roughly the work required of an American Ph. D. in the same subject but without the thesis work. Students will usually complete this by age 21 or 22. This gives us an idea what can be achieved when bright children are allowed to progress from age 11 onward at their own proper pace; when they are given teachers who are themselves intelligent, well educated, and in every sense true "professionals," and when at the end of schooling there is a definitive goal—a national diploma earned by passing a national examination which has a fixed value throughout the country. All this we deny our bright children.

THE ENGLISH SECONDARY MODERN SCHOOL

Now to get to the Secondary Modern School which is attended by the majority of English children. These schools are often dismissed by visiting American educators as so inferior that their products are fit only to be "hewers of wood and carriers of water." Yet all of them are as single-mindedly concerned with basic education as are the selective grammar and technical schools. Their curriculums are overwhelmingly given over to the "solids," the less able children being exposed to *more* of these basic or solid subjects rather than to fewer of them. There is none of that premature shifting of nonacademic children into vocational and life-adjustment training so prevalent in our high schools. Since many nonacademic children are clever with their hands and will be earning their living by manual skill, Secondary Modern schools make room for craftwork in their otherwise academic curriculum. But it is never allowed to take the place of the basic subjects. Rather it is used to help interest the pupils in these basic subjects by demonstrating to them the value of English, mathematics, or science in the particular crafts they like and for which they show aptitude.

As with English education in general, it is easy to point to Secondary Modern schools that are not very good. They are a new type of school that is still in process of being developed and improved. What they will be like in a few years when all Local Education Authorities will have finally met their obligations under the 1944 Act can be judged by schools in areas where this has already been accomplished. Throughout England, efforts are being made to raise the standards in Secondary Modern schools. Teacher qualifications have just been raised. Fifth forms are being set up wherever and whenever the talents and desires of children warrant adding an extra year beyond the compulsory 10-year period which ends with the fourth form. Abler children are increasingly being grouped in "A" streams that approach Grammar School level in a few subjects so that in these the children will have a chance to get a GCE ordinary pass. Each year the number of Secondary Modern children grows who continue through the fifth form and obtain up to three such passes. Their numbers may perhaps still not be significant, but as living proof that placement in a Secondary Modern School does not close the doors to educational advancement, these Secondary Modern children with GCE passes are important.

THE DIFFERENCE BETWEEN GRAMMAR SCHOOL AND THE SECONDARY MODERN SCHOOL

The difference between a grammar education and a secondary modern education is less one of kind than one of breadth and depth of programed subject mastery—a difference that is dictated solely by the difference in mental capacity of students in these two schools. There is just so much that can be done for children whose intelligence ranges from IQ 110 down to 80. A considerable number of them cannot progress beyond what abroad are termed "elementary" subjects—reading, writing, arithmetic, geometry, and the elements of history, geography, nature study, plus art and music. These subjects are taught intensively and skillfully. Even children at the bottom of the Secondary Modern school intelligence range are brought to a modest literacy and numeracy.

The aptitude range of English Secondary Modern schoolchildren corresponds roughly to that of the 60 percent of American high school students for whom progressive educationists devised life-adjustment training, on the grounds that these children simply could not take academic subjects. I think the curricula of English Secondary Modern schools show conclusively that the American educationists have underrated our children.

THE ENGLISH SECONDARY AND OUR SECONDARY SCHOOLS

There isn't time here to describe in detail what children achieve in Secondary Modern schools but I can tell you how much time is allotted to academic subjects. I have tried to translate these time allotments into Carnegie units so one can compare the effort put into basic education by the Secondary Modern school and by our high school. Since he has a longer school day and year, the English pupil gets more class instruction per year of schooling, so that 4 years in Secondary Modern school is equivalent to almost 5 years of American schooling.

The Secondary Modern schools follow the Grammar School pattern of starting children off with a program leaving little or no choice of subjects. This is thought of as a sort of testing period to give children a chance to try a broad range of subjects before settling down to what they consider their preferential subjects. By the third year, children's programs will be weighted somewhat in favor of their specialties. In Secondary Modern this specialty will normally be a practical course in housecraft, commercial subjects, or shop. Over the whole of the Secondary Modern program, these practical subjects will average out to about one afternoon a week; the rest of the time is given to the "solids."

Taking only the compulsory period of 4 years in Secondary Modern school, I find that the time allotted to *English* over the 4-year course is about equivalent to the time needed to acquire 4½ Carnegie units in the United States; for *mathematics* it is likewise 4½, for *history* and *geography* 3, for *science* 1 to 1½; a total of 13 to 13½. Those who take a *foreign language* will add another 3 units and get 16 to 16½ units. In most American high school college preparatory courses 16 units of academic subjects are all that is required for a diploma. Obviously, English Secondary Modern schoolchildren do not get as far in these subjects as the brighter American high school students, but then these should be compared with their intellectual counterparts who are in the English Grammar School. I seriously doubt American children in the ability range IQ 80–110 get as good a basic education as similar English children in fully developed Secondary Modern schools. How can they, when in most of our schools they are not held to a program weighted as heavily on the "solids" as it is in England?

ACHIEVEMENTS OF THE SECONDARY MODERN SCHOOL

It must not be thought that the Secondary Modern School is one continuous grind. There are no semiprofessional athletic spectacles, but every child is required to participate in games and exercise. There are no courses in how to set a table, or order a meal in a restaurant, or place a long-distance telephone call, or "how to be likable, lovable, and datable," but teachers make a deliberate effort to improve children's speech. There is none of the nonsense about every kind of speech being "equally" good or about letting children make up their own rules of grammar that is to be found in some of our schools. Teachers try to get children into the habit of speaking what they sometimes call "the Queen's English;" not the Oxford accent but a good, clear, pleasant way of speaking. When you visit England you notice how rarely *young* Londoners talk with a Cockney accent. A general improvement in speech is taking place for which Secondary Modern teachers deserve the full credit.

They also try tactfully to improve children's manners. Again, they do not give a "course" in deportment. What is commonly done is to use the lunch hour to introduce children to the idea that meals should be properly served, properly eaten, and accompanied by pleasant conversation. A teacher may have a group of 12 or so who sit at a table "family style"; the children take turns fetching the food in large serving dishes and unobtrusively they are taught, without knowing it, how to behave at table. Secondary Modern schools also have many clubs and other extracurricular activities but these do not intrude on class time—they are after hours.

Of course the tone varies from school to school since in England so much depends upon the head of the school and the faculty. What a Secondary Modern School with an outstanding headmaster and a good faculty is able to achieve may be seen by a school I heard about which did particularly well in mathematics and science. Pupils in the top or "A" stream of this school did some calculus, conic sections, and various forms of mechanics with surprising facility. In *all* the mathematics classes of this school pupils calculated with accuracy and used mathematical forms of expression with understanding and discrimination. Their ability to see the wider significance of situations having a mathematical implication was not a result of higher mentality; they were students reaching down into IQ 85 and up no higher than about IQ 110. This school had good mathematics teaching and it had caught the students' imagination. Two-thirds of them continued some form of education after graduating; a few became engineers, many became technicians and skilled craftsmen. Such schools are not yet the rule but they are what the English hope for.

What interests me is the work done in *good* Secondary Modern schools. Because of the English tradition of "streaming" pupils in all schools, there is much we can learn from England as to what is *attainable* scholastically by children in different intelligence ranges. I am very much concerned at the plight of the million or so of our children who drop out of high school in the 10th or 11th grade. We seem unable to find any kind of rewarding work for them. I feel strongly they have been badly served by being given life-adjustment training rather than basic education. I think the English schools are on the right track when they give *more* English and mathematics to their less able children; it takes these children longer to achieve mere literacy and numeracy. Elementary literacy and numeracy are minimum skills *everyone* must have to live successfully in modern urban communities. We haven't really made an effort to discover how much basic education our least able children *can* absorb.

I tried to get some information on what the Secondary Modern schools are able to achieve in English and mathematics with their least able children. The Manchester education authorities kindly supplied me with a number of samples of classroom work and test papers done during the fourth form. The majority of these children have not yet reached age 15; a few have had their birthday but have stayed on to complete the trimester. I asked for work done by children in the lower ability streams, as well as by those who are average *for the Secondary Modern school.* The abler children's attainments can be judged by the fact that they try out for a few GCE ordinary passes. May I request permission, Mr. Chairman, to include a few samples in the record? And for comparison also some writing done by nonacademic American children taken from a magazine article. We recently took a talent survey of half a million American high school children which showed disturbingly poor work in spelling and composition. May I also include in the record a few samples of such test work that have been widely reported in the press?

Finally, I should like to include an article written by James D. Koerner, describing his experience when giving an English refresher course to a number of American elementary and secondary school teachers. The course was mandatory for maintenance of their qualification records. The spelling of these teachers is really not much better than that of the Manchester Secondary Modern school children.

Mr. CANNON. They will be included in the record.

(The matter referred to is included as Annexes 2, 3, 4 and 5.)

TEACHER CERTIFICATION

Mr. CANNON. Will you proceed, Admiral Rickover.

Admiral RICKOVER. A fourth of our elementary school teachers have not attended college; half our high school English teachers have not majored in English at college; you can be certified to teach in elementary schools in two-fifths of our States without meeting any requirements in English; and in this country as a whole, on the average, you can be certified to teach *secondary school English* on the strength of no more than two semester courses in *beginning* compositions. In contrast, English primary and Secondary Modern schoolteachers with exception only of those teaching nonacademic subjects *must* be graduates of the teacher-training colleges—which now are 3-year institutions. To be admitted into these, they *must* now have a good advanced GCE, in itself equivalent or nearly so to a good American liberal arts bachelor's degree and greatly superior to the average American teachers college bachelor's degree. And that is just for *admission* to the teacher-training college! Only about 6,000 English teachers are substandard. In our country over 90,000 do not meet even our very modest certification requirements.

With better teachers and with concentration on basic education, it is no wonder Secondary Modern Schools do a better job educating children of average and below average ability, just as Grammar Schools do a better job educating children of above average ability. And could we not profit from these English accomplishments?

EXAMINATION OF THE VALIDITY OF THE ENGLISH SELECTION SYSTEM

Mr. CANNON. Well, Admiral Rickover, you make a persuasive case for the English system. But is it not true that whether a child gets a Grammar or a Secondary Modern education is decided for him by the school or some other authority and neither his wishes or those of his parents are taken into consideration? It is all decided by this one test they take at 11. Isn't that too narrow a pivot? Would you want us to copy that arbitrary procedure?

Admiral RICKOVER. You have put your finger on a crucially important point, sir. It's on the selection procedure that everybody who dislikes separate secondary schools concentrates his attack. Of course, a selection system that is not fair and reliable would fall to the ground certainly in the United States. Four accusations are made against the English selection process:

First, that the test is unfair in that a child of the same innate capacities may be placed in Grammar School in one locality and in a Secondary Modern School in another. In some areas Local Education

Authorities have more grammar places at their disposal, hence it is easier for children to get into the Grammar school.

Second, that it is impossible to predict at age 11 whether a child is or is not fit to do the work in Grammar or Technical School.

Third, that the so-called "11-plus" exam is a cruel "day of judgment"—that little English children have their whole future decided by their performance in this one examination, and they may have a cold or have something else wrong with them that day, and so do badly.

Fourth, that the examination itself is class biased, in that children from middle- and upper-class homes are bound to do better and, as a result, preempt the Grammar School places while the Secondary Modern is the "working class school." I have taken special pains to obtain information on the "11-plus" examination. Except for the first point, these accusations are not valid.

GEOGRAPHIC IRREGULARITIES BEING STUDIED

I discussed the problem of geographic inequalities a little while back. They are the result of differences in resources among the Local Education Authorities. Some have been able to carry out fully their obligations under the 1944 Education Act and so can provide enough grammar places to take care of every child with genuine academic ability. Others have not yet been able to do this and so have fewer places than there are talented children. Admittedly, this produces inequalities. But so does every school system which leaves responsibility largely in local hands. An American child's educational opportunities are likewise unequal. He will get much better public schooling in one part of the country than in another. The English have a plan to equalize geographic differences through their grants-in-aid to schools. But postwar difficulties have prevented them from wiping out the inequalities as rapidly as they would wish.

This problem is a larger one than selection through the "11 plus." Even if there were no selection into different types of secondary school, differences in educational resources of particular local communities would affect an English child's educational chances, even as they affect our own children's educational chances.

England's past procrastinations are certainly to blame in part for the plight of the talented child who misses out on a grammar education because his parents reside in a locality with inadequate educational facilities. Had England done in 1900 what she postponed till 1944—that is, established a full primary-secondary school system supported out of taxes and charging no fees—she would have had the financial resources to undertake a much larger school-building program and to equalize local differences through much more massive grants-in-aid. At the turn of the century, England was the richest country on earth; in 1944, she was impoverished by war.

Rather than criticize England for such inequalities in the "11 plus" as still remain, we ought to take this to heart as a lesson for *us* not to emulate England's past dilatory ways. Her children today are paying for the inaction of their English grandparents. Just so will *our* grandchildren tomorrow be paying for our own sins of omission—if we persist in them. I don't know whether we will forever be the richest country on earth, but I do know that it is easier to improve our schools today than it will be a few years from now when our fast-growing child population will tax education facilities so greatly that we may not even be able to give them as much schooling as they receive now. It seems a pity that the people who delay reform are never the ones who suffer the consequences. It is always the children who must bear them.

THE 11-PLUS EXAMINATION CONSIDERED IN CONTEXT

The argument often made by American educators that it is impossible to determine at age 11 whether a child will be capable of pursuing a grammar education rests, I believe, on a misconception of the purpose of the "11-plus" examination. As I explained, it consists of an IQ test and of written examinations in arithmetic and English. Only the IQ test is, strictly speaking, prognostic. The other examinations simply reveal whether a child has reached a plateau of learning that allows him to move into the grammar program. A capable teacher who is himself intelligent, well educated, and professionally qualified can tell by the child's performance in the "11 plus" whether he has mastered the primary program well enough to be able to begin the grammar program. If the child can't read with ease, he will be unable to keep up the grammar pace which involves a vast amount of reading; if he hasn't mastered arithmetic, he can't start algebra in the first form, where it is required, and so on.

American educators are unfamiliar with rigorous academic curriculums; with the consistently sequential course programs common to European school systems, where each year's program is based on what has been learned in the preceding year. In such systems the pace is rapid because there is no backtracking, no repetition of courses previously taken. Promotion cannot, therefore, be automatic; it must be based on a child's having done well enough in a given grade to be able to do the work of the next grade.

In one sense the "11 plus" is not fundamentally different from class tests that determine whether a child will be promoted *within* the same school. What gives it such great significance is that it comes at a point in a child's educational life when his further progress will depend squarely upon possession of intellectual capacities that are relatively rare in all countries.

ACADEMIC CHILDREN

English, indeed all European teachers know from experience that normal children, when properly taught and motivated, can master the elementary school program. The less able may need twice as long to do so than the more able, but they can all complete this program. It is otherwise with secondary school programs. To pursue the course of studies in the English Grammar School and in similar schools on the Continent has always required ability to think in abstractions, to synthesize ideas, to grasp complicated interrelationships, and to absorb and apply a large amount of academic knowledge. In no country is this ability possessed by more than a minority of children. This is what the English mean by "academic children"; they are the children who have this ability. Such children, with few exceptions, learn fast. For this reason they are generally well ahead of less able children at the end of the 6 years of primary school; this shows itself in their performance on the "11-plus" test.

English teachers know an "academic child" when they see one. That is what they themselves once were. As I mentioned, all teachers must have completed a full grammar course before they even begin their professional studies, the only exceptions being teachers of nonacademic subjects—craft, shop, or physical education teachers, et cetera, who, at any rate, are not concerned with the "11-plus" sorting out process. It is this personal familiarity with the nature of grammar education, with the demands it makes on innate intelligence, which most American teachers and educators lack. Many of them have not had the equivalent of a grammar-type education.

AMERICAN CRITICS' EGALITARIANISM FAULTY

Imbued with the progressive philosphy of education—often the only education philosophy taught in teachers colleges—our teachers do not clearly understand that evaluating a child's scholastic achievements is a natural part of the education process. They get it mixed up in their minds with some sort of value judgment of the child as a human being, which they believe must be avoided at all costs in a truly "democratic" school. As Mr. Spears did when he remarked that a "democratically inclined" school principal will not allow the high school diplomas of his students to show what they have studied. To Spears this would be "discrimination" since in his opinion it would "imply that the accomplishments of the youth who did not take the highly academic lane were less worthy."

This excessive concern with protecting children against the consequences of poor school performances creates an artificial hothouse atmosphere in our schools. Why ever should a prospective employer or the admission officer of a higher school not be given accurate information on what the holder of a diploma has achieved in high school? He is going to find out anyway. Meanwhile children are deprived of the salutary spur that academic reward provides. Studying is hard enough. Why not use good marks, promotion, diplomas, and similar rewards to make it seem worthwhile to the young?

It is perhaps not surprising that teachers conditioned to the progressive way of thinking see in the "11 plus" only a cruel judgment day when the sheep are separated from the goats. The intellectual egalitarianism they absorb in teachers college tends to make them skeptical that there actually are such persons as "academic" and "nonacademic" children. They are inclined to ascribe all or most differences in scholastic performance to "socioeconomic" causes. For this reason, not only the "11 plus" but any method of selection for different secondary schools—in fact the whole idea of different secondary schools for children of different abilities—is unacceptable to them.

English teachers who have had contacts with American educators are puzzled how often these express viewpoints that in England are found only among people who are politically on the far left. These are the people who in the years when England first began to implement the 1944 Education Act engaged in much irresponsible talk of making all three types of secondary school equivalent. Some wanted to do this by omitting any outward indication as to what kind of secondary program a particular school provided. Others felt that equivalence could only be achieved if all three types were combined in one huge comprehensive school. For purely political reasons this has been done in a few localities. It was done for no other reason than to placate those who confound intellectual excellence with upper class privilege.

Administratively, these mammoth schools are institutions as clumsy as some of our own huge high schools. But one must not make the mistake of believing that they have been patterned after the American high school. The English are quite insistent that separate types of secondary schooling be carried on in these comprehensive schools, exactly as it is when each type is housed in a separate school. All the schools are "streamed" by ability. One large school, for instance, has 15 streams, and what is being taught in the top stream has nothing to do with what is taught in the bottom stream; the two might as well be housed in separate buildings of manageable size.

ABILITY GROUPING A NECESSITY

It cannot be stressed too much that education, if it is to have any intellectual content, requires that children be grouped in a way that will permit them to proceed together; that is, where the whole class can participate because the mental ages of the children are fairly homogeneous. Separate schools are preferred abroad, except in Russia and her satellites and in some localities where socialist parties control the government. The undifferentiated "common" or comprehensive school has, of course, long been an important item in European socialist and Communist Party platforms. It is rather odd, when you come to think of it, that the only Western country where the whole educational establishment is committed to this tenet is the world's least socialist country—the United States! We are indeed the only nation among the free countries of the West where the schools try to equalize educational chances by bringing the curriculum down to the level of the average; and where the *technical* task of the school is subordinated to social leveling.

There is much talk of improvement in American education, but the people who brought the school crisis upon us are still in the saddle. They still label "elitist" any proposal that we give our bright children educational opportunities equal to those enjoyed by bright children abroad. For example, only a little over a year ago, at a conference of educators held in the Office of the U.S. Department of Health, Education, and Welfare, warnings were expressed against ability grouping, and the solemn declaration was made that the school "never forgets that a democracy can rise no higher than the level of its average citizen."

Just think of the implications inherent in this statement—that our country can never hope to do better than is warranted by the ability of the average citizen. Yet all of us know that we depend on above-average persons for the innumerable services professional people provide us with, for all the marvels of science and technology, for all the best in art, music, literature, philosophy, ethics—to name but a few—for top leadership in all spheres.

EDUCATION AND LEADERSHIP

One of England's great educators, Eric James—now Lord James of Rusholme—in a small book called *Education and Leadership*, brings out more clearly than I have seen it stated anywhere that in no society is the quality of leadership so important as in a free democracy. Chief among the qualities required of a leader in today's complex life is trained intelligence of a high caliber. "The good leader in any field must be a person of high intelligence," writes James. To develop the intellectual power of talented youth is therefore an important responsibility of a democratic school system since, "although not all of them may be expected to become leaders, leaders will in general be recruited from their ranks."

I suspect that in no country is so much written and said about "leadership" as in the United States. Yet in trying to define the qualities that make a good leader, we never give enough weight to sheer intelligence, to educated intelligence. The emphasis is all on qualities that make a person a good organization man, someone who knows how to project a favorable image of himself and who is skillful at manipulating the people under him so they will be "happy" while doing what he orders them to do. We think it more important that a leader have a smattering of knowledge in sociology and psychology than that he be a broadly educated man who not only knows how to direct complicated enterprises but who also fully understands their technical task.

James shows clearly that whatever attributes may be desired in a leader, high mental endowment must be reckoned the one indispensable quality. And so he rightly says that "it must surely be one of the tasks of democratic education to develop those qualities. If society is forced to place authority and responsibility in the hands of certain individuals there can be no more urgent task for education than to see that these individuals are adequately prepared for their task. Rightly considered," he concludes, "education is the greatest safeguard that leadership shall be not only wise but democratic."

James makes short shrift of a well-known American educator who recognizes some of the drawbacks of our educational practices, yet firmly declares that "we are committed to a democratic undifferentiated education." Says James:

> The fundamental confusion in his mind is shown by the association of a democratic education with an undifferentiated one; the confusion is between an education differentiated on social grounds and one which is differentiated because only in that way can the individual needs of the child be met. The conflict is between two incompatible interpretations of the idea of equality; according to one it is a principle by which fair opportunity is given to all, including the most gifted; the other sees the word as a magical incantation which removes all human divergences.

Here you have a clear-eyed and intelligent concept of "education for all" that stands in glaring contrast to the muddled egalitarianism so rampant in American educationist thinking.

This should be evident beyond question to anyone who examines the performance of English children, as shown in the samples included in this report. There is a large gap between the achievements of Secondary Modern Schoolchildren, no matter how intensively they have been instructed in the basic subjects, and those of Grammar School fifth formers taking a GCE "ordinary" level examination in five or six academic subjects or sixth formers taking a GCE "advanced" and "scholarship" level examination in two or three additional subjects.

How can American educationists seriously argue that one must keep children together for 12 years when the brightest might, in a separate school, by age 18 be capable of successfully passing the

Oxford and Cambridge GCE "advanced" and "scholarship" level examinations in mathematics, physics, and chemistry, while the least able will do work as exemplified in the two essays on "America" by Manchester children? And can we be happy when we compare these English achievements with those of the talent survey of half a million average American high school children, or with the written work described in the *Ladies' Home Journal* article, as given in Annexes Nos. 3 and 4 of this report? Surely it must be evident to any unbiased person that we handicap our Nation and our children by refusing to provide secondary schooling appropriate to their ability. We cut off our nose to spite our face when for the sake of egalitarianism we refuse to provide proper education for our bright youth. The English data show moreover that not only bright children but average and below average children as well profit by being given an education that challenges them; this necessarily requires separate schooling.

Our unquestioning acceptance of the dogma that the only acceptable public education in a democracy is undifferentiated comprehensive schooling blinds us also to the good effects which higher secondary school tracks exert on teachers and pupils in lower secondary tracks. Certainly in England we can clearly see that the private boarding schools, such as Eton, Winchester, etc., served as models to the state Grammar Schools, and that today the Grammar Schools have stimulated the Secondary Modern Schools to raise their sights. Of course, the fact that English teachers are intelligent, well-educated professionals accounts for their surprising success with quite modestly endowed children, as in the case of the school I mentioned where mathematics is pursued most successfully. The children themselves respond to the challenge of a higher secondary school. They are, as we all know, little copycats and so it is not surprising that English Secondary Modern School children often want to emulate Grammar School children. They have been known, believe it or not, to demand homework, just because homework is done in the Grammar School! English children not infrequently are ahead of their working-class parents who can't see the purpose behind all this studying when in prosperous England wages are not far behind professional salaries. Such parents sometimes make more money than teachers; so they do not understand why their children have to do homework if they want to prepare for an examination. Teachers often donate their time to keep school open in the evenings so children can do their homework there in peace and quiet; at home the TV will be blasting away. These are some of the problems that accompany a country's attempt at massively upgrading itself.

With us, not only primary but secondary schooling as well are comprehensive, and the school's overriding objective is to "hold" all children for as long as possible, if necessary by denuding education of intellectual content. Scholastic standards are, therefore, bound to slip to the level of the average or below average pupil. This is the inevitable consequence of our commitment to common schooling. It may look at the moment as if nothing could ever make us change our view that no public school system is democratic unless the future nuclear scientist studies the same core program side by side with the future parking lot attendant, but necessity has forced many another country to reform its schools, and I have no doubt necessity will compel even us to overcome our obsessive dislike of separate educational tracks. As the late Dorothy Thompson once wrote, "we should encourage all kinds of individuals to run on all kinds of tracks." And she warned that we must insist that—

> democracy is not to be conceived of as an invitation to share a common mediocrity, but a system that allows each to express and live up to the special excellence that is in him.

The hard fact all democracies must face is that in modern life certain services that are essential to everyone's well-being and that no modern state dare neglect can be provided only by a minority. Modern industrial societies depend upon their intellectual elites to an extraordinary degree. A country such as England cannot survive unless she gives her talented youth the kind of education that will bring out their best capacities. This requires early separation so that a rigorous academic program can be begun around age 11.

In his comparison of English with American education, Edmund J. King takes note of this grim fact. A country like Britain, which has limited raw resources and must earn abroad by its skill at least half the food it eats, just cannot afford extravagances with time.

> 'If you don't earn, you don't eat' is a lesson that is dinned into British heads incessantly in postwar years, though in various grades of politeness. Standards of skill and knowledge can hardly be abandoned without disaster.

Necessity forces men to think clearly. Necessity has forced the English to have a more realistic conception of their educational needs than we have. But in the days of their glory they also were blind even as we are blind today. Today England cannot permit herself the luxury of indulging in practices that may be dear to her but that will prevent her from being educationally competitive with the rest of the civilized world. We seem to think we can still afford to do so. Yet there is not much time left us before we must awaken to the brute fact that to survive we too must become educationally competitive with other advanced nations.

The existence of national examinations at various scholastic levels—chiefly the GCE but also the ordinary and higher certificates and diplomas—has been a great spur to a marked upgrading of English job specifications. I was struck the last time I was in England with the number of rather modest white-collar jobs advertised in the newspapers which will have the notation: "Required: Two (or three) GCE passes;" sometimes the subjects are specified, as "one in English, and one in mathematics." Democratization of education has brought about a noticeable educational upgrading. Visitors have commented on the disappearance of cockney English. To my ear, many clerks in stores and banks now speak with a very pleasant accent but I am of course no judge of their language.

The Ministry have put out a booklet listing professional bodies or associations that will accept a specified type of GCE in lieu of the examinations they formerly administered for entrance into professional schools or for association membership. I pick at random the Chartered Institute of Secretaries which will exempt from preliminary examinations anyone who possesses four "ordinary" GCE passes which must include English, mathematics, and two of the following: history, geography, Latin, or modern languages. Civil service clerks are exempted from written exams if they have five "ordinary" passes, taken at no more than two sittings, one to be in English. The Society of Radiographers requires four ordinary level passes, including English, mathematics, and two science subjects; the Worshipful Company of Spectacle Makers requires of those who wish to register as a student associate that they have four ordinary passes. The Society of Auctioneers and Landed Property Agents demands two ordinary level passes—English and mathematics—for exemption from intermediate examination in their vocational course. And so on.

I can see nothing "un-American" or "undemocratic" in measures that spur young people to improve their minds and their human competencies, even if this must lead to inequality in achievements. And for the life of me, I cannot understand why American educationists attack as "elitist" the English school system which so clearly recognizes talent and offers every child the kind of schooling that will develop his talent to the fullest? Why, in a modern society there is no better way to overcome handicaps of birth than first-rate free education. "It is only by such an education," writes James, "that the limitations of the social, economic, and cultural backgrounds of the individual can be transcended."

Education must now do for our "socioeconomically underprivileged" children what America's wide open spaces and her huge natural resources did for them in the past. It must offer them an opportunity to rise through their own efforts and through making fullest use of their innate capacities. *A school system with separate secondary schools benefits no one more than the talented poor child.*

ENGLISH PROVISIONS FOR THE "LATE BLOOMERS"

The argument against determining at age 11 whether a child is able to do grammar work is usually clinched by triumphantly bringing up the case of some famous man who did badly at school. Winston Churchill is always cited by English critics of the "11 plus." I have been reliably informed that it is most unlikely he would have failed the test; his IQ would have been enough to alert teachers to his potentialities!

But it is quite true that there are some children—very few fortunately—who depart to such an extent from the general pattern of academic and nonacademic children that the "11 plus" may do them some injustice. There are children who have a good mind but who learn so slowly that they would need tutoring, as well as all the time in the world to complete a grammar education. There are also children whose mental development is unusually slow, the "late bloomers." They are always cited by the critics of the "11 plus." They may not awaken intellectually until they are much older than 11. Meanwhile they have hopelessly dropped behind.

One must be realistic about these children. A mass education system, especially one that is being rapidly developed and which has only limited funds at its disposal, simply cannot do full justice to such children. The English, as well as the continental school systems do their best. One way is to let slow learners repeat grades; this is quite commonly done abroad. Another is to spread the net wide enough in the selection process to catch every child who shows the least indication of academic ability. This, too, is common practice abroad. It is done to a greater extent in the older continental school systems which have long had tax-supported secondary schooling and where a more generous selection can be made since there are more places available in the higher secondary schools. England is harder pressed. But even she includes in her selective schools so many that fully a fifth later prove not to have had the requisite ability, and another fifth get little more out of their grammar education that they could not have obtained in a secondary modern "A" stream.

Among them are the 19 percent of Grammar School children who break the promise, made by their parents when accepting placement for them in Grammar School, that they would stay on to the end of the fifth form, a year beyond the compulsory period of schooling. They drop out earlier. Another fifth of Grammar children obtain fewer than three "passes" in the GCE "O" level examination. These two fifths might just as well have been placed in a Secondary Modern School.

It is nonsense to misrepresent the "11 plus" as a day of terror when a little child's whole future hangs in the balance and some fortuitous factor may swing it toward educational success or failure. There are no inhuman machines punching out the decision where the child will be placed. The tests are administered by teachers, the child's record at school is taken into consideration in most instances, and there are means to rectify errors in placement. Here again geographic inequalities play a part, and availability of grammar places determines how many borderline cases can be given a chance at a grammar education. Outright errors are extremely rare. In localities that live up to the 1944 Act, as for instance the city of Manchester, it is most unlikely that a child will be placed in the wrong track without his teacher discovering it and having it rectified. A recheck after 6 weeks or 2 months is part of the regular "11 plus" sorting out process. This is done for all children whose teachers feel their performance in the examination was not a true indication of their ability and potential.

The Manchester Education Department was good enough to send me their figures on a recheck for a typical year when 10,000 children moved from primary to secondary school. Only 675 cases were reported by heads of schools, or about 7 percent; of these just about half were placed in a different, and only 1.4 percent in a *higher* type secondary school. There is another routine recheck at age 12 permitting transfer of "late bloomers" to Grammar School. Finally the ablest, who complete a 5-year course in a top or "grammar-type stream" of a Secondary Modern School, have another transfer chance at age 16. How much more can a mass education system do for maverick children?

ADULT EDUCATION OPPORTUNITIES

Moreover, England like the Continent has numerous facilities for so-called "further education." In these, students prepare for some vocation, semiprofession, or profession and, as part of this specialized training, also expand their general education. Not a few acquire in these schools the requisite knowledge eventually to take a good GCE ordinary or even advanced level examination.

There are almost 9,000 institutes, colleges, and schools of various types where currently over 2½ million young English men and women study full or part time, in day or in evening classes, in a "released time" or "sandwich course." Released time courses are those taken 1 or 2 days a week by apprentices whose employers usually pay them while attending school. Sandwich courses are essentially the same, except that schooling and apprenticeship are taken in time blocks—6 months full schooling alternating, for example, with 6 months full work. Both types of postschool education are available here too, but I should judge that proportionately more young people take them abroad.

The 1944 Act requires Local Education Authorities to provide full-time and part-time education for persons over the compulsory school age of 15 who want it. In the various institutions of "further education" large numbers of students work toward craft certificates, or toward the ordinary and higher national certificates and diplomas that are needed by technicians and engineers and comparable occupational levels in other fields. All these facilities are being rapidly expanded. The Ministry of Education, the universities and technical colleges, industry, the schools, and the teachers are all cooperating. As a result, 50 percent of England's employed are skilled craftsmen, another 12 percent are semiskilled. There are fewer unskilled machine operators in England than here, and she has no functional illiterates, at least among people of normal intelligence.

One can hardly claim that the existence of selective grammar and technical schools has meant educational deprivation for the nonacademic English child as compared to his American cousin. In both cases more educational opportunities are provided by society than are made use of, but in England at least every child must and does get 10 years of schooling; these 10 years, as I pointed out, contain nearly as many hours of school instruction as do 12 here. As late as 1958, 49 percent of our children did not graduate from high school; worse still 14 percent left at the end of the *fifth* grade; a quarter quit school with 10 years *or less* of schooling. American early dropouts rarely obtain as much "further" education as do English children.

THE "11-PLUS" SORTING PROCESS: BORDERLINE CASES

To get back to the "11-plus" sorting out process. Most children are clearly either academic or nonacademic; therefore the choice of secondary school is easily made. One hears a good deal of talk about so-called borderline cases but, except in localities where there is a severe shortage of grammar and technical places, the number of these is much smaller than one would expect, judging by the outcry they cause.

Two things are usually overlooked by people who are so concerned over borderline cases that they would scuttle the whole selection process rather than allow the handful of children who just conceivably *might* have it made through Grammar School, to be placed in a Secondary Modern. They overlook the fact that grammar and technical schools cannot be established overnight. Grammar school teachers cannot be produced by a magic wand. And without a well-educated and professionally qualified teaching staff, the selective schools would not be able to do their distinctive work. They also overlook the fact that most borderline cases represent a costly risk. When borderline children at the "11-plus" cutoff point in the achievement scale are placed in a selective school, experience shows that of *eight* admitted only *three* will be a success. When you reach just a little lower down the scale, you get *one* success for every *six* borderline children. A country that must make shift with limited funds has to try to use them in a way that will benefit the maximum number of children. English opinion now is veering toward putting more money and effort into building up the Secondary Modern Schools—especially their fifth forms and grammar-type "A" streams—rather than trying to spread the net for the selective schools too wide.

EXAMINATION AND CLASS BIAS

It is commonly asserted by American critics of English education that the "11 plus" has a class bias. This is true in the sense that a child's home background always influences his future. When children come from homes where an academic education is in the family tradition, where things of the mind are valued above material things, where books are read and discussed, they naturally have an advantage. In this sense every examination may be said to have class bias. Should we therefore abolish all examinations? I suspect the educationists would answer "Yes." I notice a tendency among them to deprecate the value of IQ tests on the grounds that they are "socioeconomically" biased. The Russians also stopped giving IQ tests when the results consistently went against Marxist doctrine, in that children of professional parents scored higher than workers' children. But how can a free democratic society alter this fact? Should we try to eliminate the influence of parents altogether, as the Russians seem to be trying to do with their new boarding school program? Yet even they seem helpless to prevent children of professional parents from obtaining seven times more places in higher education than would be "fair," given their number in the population. And, despite all the advantages the state bestows upon them, children of Russian workers merely hold their own numerically while children of peasants, in proportion to their numbers, get no more than one-third the places.

In England, it should be noted, two-thirds of Grammar School children are the first generation in their families to obtain more than an elementary education. Incidentally, in the private boarding schools that give a grammar education—Eton, Winchester, etc.—more than half the children also are first generation "public" school pupils. These facts do not prevent visiting American educationists from asserting loudly and repeatedly that England has a class system of education. For instance:

Two years ago five American professors of education were invited to a conference on English education sponsored by the U.S. Office of Education. Each was asked to present a summary of research he was doing on English education, this research to be concentrated on secondary education and proposals for its reform. Though accurate in details, the collection of these research pieces, published by the U.S. Office of Education, would give an American unfamiliar with English education a wholly erroneous idea of what is being done there. There is little understanding for the difficulties besetting England in the postwar years and the huge education gap she had to make up. The visiting educationists kept their eyes firmly on the iniquity of separate secondary tracks and branded them as "class" education. Wrote one of them of the Grammar School:

> The estate-system school is perfectly accommodated to the requirements of an essentially static society in performing the functions of social differentiation, and

> in maintaining and perpetuating the traditional differential social evaluation of differentiated statuses.

I am afraid this is a little over my head. I do notice that the writer foresees a future when—

> such a class-system school would encourage social evaluation in relation to social function and would theoretically eliminate the inheritance of differential statuses. With the attainment of this utopian end it could, of course, no longer be referred to as a class-system school.

Or by another professor:

> British education is still dominated by selection of a minority for magnificient educational opportunities and a relegation of the vast majority of young people to what the remaining balance in the national budget for education will buy.

THE ENGLISH GUARANTEE OF FREE SECONDARY SCHOOLING

I should mention here that while the 1944 act for the first time guaranteed all English children free "secondary education" appropriate to their capacities, England has had state-supported grammar schools since 1902. In these schools tuition was nominal, at first something like $30 a year, rising to about twice that amount by 1940. From the start many children attended these schools on scholarships. These scholarships steadily increased until, on the eve of World War II, only one-third of the children in the state grammar schools paid the full fee; some paid part of the fee and half were on full scholarships. Scholarships were won in national examinations that were quite as difficult as today's "11 plus" examination.

From 1902 to 1942 enrollments in these schools rose from 30,000 to 400,000, actually a bigger percentage jump than that following the Kalamazoo decision in 1874 which authorized the expenditure of tax money on our free high schools. What the 1944 act did was to abolish fees for everyone, but at the cost of making admission as difficult for all students as it had heretofore been for the scholarship students. This strikes me as eminently "democratic." You can no longer get into these schools by paying a fee that is small because most of the cost of the school is paid out of taxes. Now you pay nothing, but you must prove you have completed the primary school program, and that your performance in a carefully planned examination indicates you can profit from a Grammar School education.

THE FAIRNESS OF THE "11 PLUS" EXAMINATION

In my opinion, the "11 plus" is a fair examination, administered with the utmost care by teachers, not by machines. Granted the necessity of some method of identifying academically talented children, the "11 plus," especially when it is combined with the child's record in primary school, provides a reliable method for doing so. Ideally, of course, the sorting out should be done routinely in school and be no more of an ordeal than regular tests for promotion to the next class. In a few old continental school systems the selection process approaches this ideal. But in these countries there are numerous types of secondary schools, and children tend to gravitate naturally toward the ones best suited to their abilities; there is not the stark choice between selective and nonselective secondary school there is in England.

ABILITY GROUPING NECESSARY TO THE SCHOOL'S TECHNICAL TASK

When Secondary Moderns are fully developed, when all of them become five-form schools with distinctive grammar-type "A" streams, then the English sorting out will also approach the ideal, and the "11 plus" will seem no more than a routine promotion test. But no matter how much may be done to soften the process of selection, as long as England and the Continent conceive of schooling as an *intellectual* activity, children will in some fashion be sorted into the academic and the nonacademic, the bright and the not so bright. And if we ever return our own schools to their proper *technical* task, we too shall have to devise some way of sorting children. And this will have to be at a sufficiently early age so they will be able to use their best learning years to acquire the kind of education best suited to their talents. Fortunately, being very rich, we could make the selection as painless as possible. We could make it a routine process that takes place at the end of the last primary school year. And we could be very generous in giving children the benefit of the doubt; also in providing many transfer points for late bloomers and other mavericks.

The English "11 plus" should be of interest to American parents who would like their children to take a tougher secondary school course and who may be pondering the question of comprehensive versus separate secondary education. May I request permission to include in the record a sample "11 plus" examination? It is taken from a British Information Service pamphlet of July 1961, "Selection for Secondary Education in England and Wales."

Mr. CANNON. It will be included in the record.

(The matter referred to is included as Annex 6)

PARALLELS BETWEEN OUR PRESENT EDUCATIONAL SYSTEM AND THAT OF ENGLAND A CENTURY AGO

Mr. CANNON. Admiral, I believe you wished to bring out the point that there are similarities in our educational situation today and that of England a century ago. And you suggest we can learn from her what *not* to do. That is rather a wide hiatus—and not too complimentary. Would you be a little more explicit on that.

Admiral RICKOVER. Mr. Chairman, today we are confronted with clear-cut evidence that in the all-important field of education our true competitive position against certain advanced nations is unsatisfactory. Sputnik dramatized the situation for us, but there had already been many signs before. The English did not have a sputnik to awaken them to the peril of being outdistanced by their continental competitors, but the Paris Exposition of 1867 served somewhat the same purpose.

This came 16 years after the great exhibition held in London in 1851. This had been a triumph for English manufactures; they won nearly all the prizes. But at Paris in 1867 the English were badly outdone by the continental countries, winning fewer than a dozen prizes out of 90 categories.

For a complacent England it was a tremendous shock to discover that she no longer had a monopoly in modern industrial technology, that she was in fact being outstripped in the very technology she had pioneered. It took a while for the English people to realize that the

Continent, especially Germany, was forging ahead chiefly because of excellent technical and general education—most of it supported by public money and made available either free, as in elementary education, or at nominal cost, as in higher and technical education.

England then had no state education whatever. The cost of schooling was borne privately, by charity, and by endowment income. Naturally, fewer of her children received an education. This is inevitable when the cost of education is not defrayed, at least in part, by society. Nor was her education suited to the needs of a modern industrial nation. She was educationally inferior to the Continent, both qualitatively and quantitatively.

I have tried to bring out that we have allowed ourselves to fall behind educationally just as England did a century ago. And in England as here, a strong sense of national superiority kept this fact too long from both our peoples. So there are parallels in our two situations, then and now. England was slow to bring her education in line with the needs of changing times; so are we today. In both cases our respective competitors acted faster because their form of government made this possible. They are *decree countries* while England and the United States are *consensus countries*. I will now get into some detail on this.

ENGLISH PUBLIC EDUCATION IN THE 19TH CENTURY

First, a few facts about England's educational inferiority. She entered the 19th century with no *public*, that is, tax-supported education whatsoever. In contrast, many continental countries already had the foundations for a modern public school system. By mid-century such systems had been fully developed in a number of countries, the rest following suit during the next two decades. Across the channel, elementary education in free state schools developed rapidly, while England until 1870 depended on charity schools for educating the mass of her children. Two such bodies ran these schools: one, Anglican, the other representing various denominations generically termed the "Dissent." After 1833 the Government, by modest annual parliamentary grants-in-aid, supplemented the income these church schools were obtaining from voluntary donations.

Set up first as Sunday schools giving religious instruction, the charity schools "for the children of the poor" as the English called them, also provided a meager elementary education quite inferior to what was being offered in the free public school systems of other European countries. At that the English schools were not entirely free, but collected fees of about 5 cents a week, which sometimes were remitted if parents were too poor to pay. The number of children attending elementary school in England was much smaller than on the Continent. As late as 1870 one-third of England's children was receiving no schooling whatever and another one-sixth such poor schooling as hardly to deserve the name. Incidentally, in our own country half the children received no schooling as late as 1860.

England had more illiterates than other advanced European countries where virtually complete literacy had been achieved by the middle of the century. At a time when recruits in the Scandinavian and Germanic countries were 99 percent literate, illiteracy could be found in England even among persons of some standing in the community. There is a story about this: By the Education Act of 1870, England finally established a state elementary school system. Schools were put under the management of locally elected school boards, much as they still are in our country. Occasionally, London officials would find it impossible to get answers to their letters from one or the other of these boards. Letter after letter would be sent but no answer came. Eventually the mystery cleared up. It was simply that in the particular localities no member of the board could read or write! Needless to say the situation remedied itself rapidly once England followed the Continent and made elementary schooling free, universal, and compulsory.

England has been wholly literate for well over half a century. Let me say in passing that *we* are not yet wholly literate. As President Kennedy remarked in a recent address, we have at least 8 million functional illiterates, persons who may know the letters of the alphabet and be able to read some words and sign their names, but to whom work instructions and labels on medicine bottles are unintelligible. We have the schools, but the teaching of English is poor.

Also we still have a serious school attendance problem. Compulsory schooling is not as well enforced here as abroad, where during the compulsory period school attendance in countries such as England, Holland, Switzerland, Germany, and so forth, is just about 100 percent, subnormal children being cared for in special schools.

I know this is getting tedious but I want to repeat once more that the 8 or 9 years of compulsory education, so long common in Europe, represent as many hours of classroom instruction as 11 to 12 years here. Most American States require no more than 10 years of compulsory attendance. In 1958, 25 percent of our children left school having had 10 years or less of schooling. In 1948, it was more than 50 percent. It needs saying over and over again that many of our children receive fewer *hours of schooling* than is required of all children in advanced European countries. There is sufficient similarity in our present situation as compared to that of England a century ago to give us pause. Unfortunately most Americans have been lulled by illusory cliches and believe that "only *we* educate *all* our children."

ENGLISH HIGHER EDUCATION IN THE 19TH CENTURY

Nineteenth century English higher education likewise was inadequate to the needs of the times. Here too the Continent was ahead of England. From the Middle Ages, England inherited many well-endowed educational foundations. These were taken over by the Anglican church, in accordance with her claim to be the legal successor to the medieval church, and inheritor of all the rights and privileges of that church, including exclusive control over education. Under Anglican management these endowed schools and colleges, originally intended to provide higher education for "poor scholars," became the "endowed preserves of the upper classes." They were extremely expensive establishments catering to the small percentage of youth whose parents were upper- and upper-middle-class persons of wealth.

Although the church considered herself the educator of England's future leaders, endowed schools were managed for the benefit of the "fellows"—as the teachers paid out of endowment income were called—rather than for the benefit of the students. Curriculums comprised the subjects the fellows could teach rather than the subjects the students needed to learn.

The fellows themselves had been trained in a narrow classicism and passed it on to their pupils in turn. Under church management the great private boarding schools and England's two universities, Oxford and Cambridge, formed a closed education circle in which teacher and student came from the same social class and went through the same course of classical studies. There were many grammar-type schools in 19th century England in which a 16th century student would have felt quite at home. He would even have found the same Latin texts being used. Much the same was true of English universities. Urged to reform its archaic organization, midcentury Oxford replied that she operated under an up-to-date statute; by this she meant the Laudian code enacted early in the 17th century!

Under Anglican management higher education was accessible to but a small number of children. As late as 1860 Prussia, with a population slightly below that of England, had six times as many students in secondary school, and many of these were doing work that in England was deferred to the 3-year college course leading to her bachelor's degree. Prussia also had twice as many university students and these were studying for doctoral or professional degrees while nearly all English students were still rounding out their general or undergraduate education. Not only did fewer English children have access to higher education than Prussians and other continentals, but the education they did receive had little relevance to the needs of the times.

Young Englishmen who were expected eventually to occupy positions of leadership in an England that had become the world's foremost industrial nation and a great trading empire were given almost no instruction in modern languages, mathematics, and the sciences. These had long since been added to the curriculums of "classical" secondary schools on the Continent. Moreover the Continent had two alternative higher secondary schools, one a semiclassical-modern language, the other a mathematics-science school. Students with various talents and interests could find schooling that suited their particular objectives. The Anglican churchmen considered nothing but a classical and literary education "suitable for gentlemen."

Equally narrow was the range of subjects offered at English universities. To quote Sir Eric Ashby:

> On paper the pattern of Oxford was consistent with its generic status as a medieval university. It had a dual function: as a group of colleges where young men could study the trivium and quadrivium as a preliminary to their professional training; and as a group of professional schools providing advanced study in theology, medicine, and law.

The first of these functions was discharged by tutors who taught all the subjects required for the bachelor's degree—ancient history, Latin and Greek, poetry, philosophy and logic, mathematics. Ashby said of these tutors, that "they were in fact schoolmasters." The second function of the university "though nominally recognized, was actually ignored." As late as 1852 the Regius professor of medicine reported that he had discontinued his lectures. He formerly had 10 students a year and the numbers had dwindled to 4. Professors in the sciences likewise had few students. Through most of the 19th century medical and legal education was provided outside the universities. Though England produced noted scientists, "British universities except fortuitously and incidentally played no part whatever."

HIGHER EDUCATION ON THE CONTINENT IN THE 19TH CENTURY

On the Continent, meanwhile, a radical modernization of the medieval university had taken place. It was begun in Prussia. The University of Berlin, founded in 1809, was the first truly modern university. Subsequently it became the model for most continental universities. While Oxford and Cambridge lost their professional faculties, except in Anglican theology, and became almost wholly undergraduate, continental universities eliminated undergraduate studies and became graduate institutions where teaching and basic research were combined, to their mutual benefit. Undergraduate work formerly done in universities was now transferred to the academic secondary schools.

Matthew Arnold noted in one of his studies of continental school systems, that Oxford and Cambridge were not universities in the continental sense of the term. They were a species of academic secondary schools—

> where youth of the upper class prolong to a very great age, and under some very admirable influences their school education * * * they are still, in fact, *schools*, and do not carry education beyond the stage of general and school education. The examination for the degree of bachelor of arts, which we place at the end of our 3 years' university course, is merely the *Abiturientenexamen* of Germany, the *épreuve du baccalauréat* of France, placed in both of these countries at the entrance to university studies instead of, as with us, at their close.

This, I should like to mention, is no longer true of the English bachelor's degree which is now awarded for largely *graduate work*, but it is still true of most if not all American bachelor's degrees.

SCIENCE IN THE 19TH CENTURY IN ENGLAND AND ON THE CONTINENT

England's higher education facilities were thus qualitatively and quantitatively inferior to those of continental state school systems. Worse still, they were particularly inferior in science which by that time already had become the very touchstone of a country's educational system. Science was almost completely neglected in England. While laboratories had long since become standard in continental secondary schools, they were still not even dreamed of in England. An interesting comparison was made by England's eminent chemist, Edward Frankland, in an article written for the magazine *Nature*, April 6, 1871. "We in this country," he wrote, are in regard to scientific discovery "conspicuous for our prominent position in the rear." To support this statement he gave the results of an inquiry into the comparative activity of England and other countries in chemical research.

In 1866, a total of 1,273 papers on new discoveries were published by 805 chemists, 1.58 papers being thus the average product of each investigator. Of these Germany contributed 777 papers by 445 authors, or 1.75 papers to each author; France 245 papers by 170 authors, or 1.44 papers per author; while the United Kingdom contributed 127 papers by 97 authors, or 1.31 papers per author. He goes on to say, that—

> from a purely national point of view, our case is even worse than it appears to be from a comparison of these figures, since a considerable proportion of the papers contributed by the United Kingdom were the work of chemists born and educated in Germany.

In 1845 England had established the Royal College of Chemistry. An astute American observer of Victorian England, George Haines IV, aptly calls it "a sort of German chemical laboratory in England." For some 20 years this college was staffed by imported German university professors who taught chemistry to the English and set up chemical industries in England—for all the world as if they were assisting a "point 4" country. Many of the allegedly English chemistry papers listed by Frankland were written by these German scientists. In passing, I note that there was no reverse export of English professors to the Continent.

To prevent us from feeling smug, it is well to remember that basic research for the atomic bomb was done in Europe, the idea to build the bomb was conceived by émigré European scientists, and these made up a very large part of the talent that ultimately produced the bomb and thus hastened the end of the war in the Pacific.

I tried awhile back to estimate how we stand in higher education. As throughout our educational system, we seem at first sight to have huge quantities of students in the classroom, but when the time they have spent in studies and the quality of their work is figured in, one can find no great numerical advantage over Europe. Qualitatively, European education is better. We have been as slow as England was to recognize our true educational situation. In both our countries insularity contributed to widespread ignorance of the status of education abroad.

NINETEENTH CENTURY ENGLAND'S ISOLATION FROM THE CONTINENT

England's educational isolation from the Continent lasted almost four centuries. It began when Henry VIII rejected the supremacy of the Pope and made himself head of the Church of England. This church for a long time had no affiliation with either the Catholic or any of the Protestant churches. It has been suggested that England's insularity, at least in part, was a consequence of the fact that Anglicanism has no coreligionists in the rest of Europe. The case of Scotland is cited to support this explanation. Calvinist Scotland kept its ties with continental Calvinist churches and universities, especially those of Holland. For these reasons Scottish education remained competitive with the Continent.

This explanation seems reasonable, given the fact that until well into the last century schoolteachers in Europe, especially those in higher education, continued as in the Middle Ages to be clergymen or theologians waiting for a clerical position. A century ago most of our own college presidents also were theologians. It may well be that these clergyman schoolteachers would be more interested in what was being done in foreign schools if the teaching staffs of these schools were religious confreres.

OUR EDUCATIONAL ISOLATION

Since the takeover by progressive educationists, we too have been living through a period of educational isolation from the rest of the Western World. Before Dewey, American educators were fully conversant with education abroad, they had the same traditional conception of the nature and objectives of formal schooling and so there was mutual exchange of educational ideas. But progressivism looks upon the school from a viewpoint diametrically opposite to what is traditional in the West. This viewpoint has never been adopted as the basis of public education in any other Western nation. For a brief period, the progressive theory of education was, however, officially adopted by Soviet Russia for her schools. Our progressives now have no confreres abroad.

So they have kept us in isolation from European education and given us a good deal of misinformation that has prevented us from recognizing in time that we were falling behind. American educationists find nothing in European education they consider of the least value to us, so one can but wonder why they take so many trips abroad at taxpayer's expense. Englishmen eventually rediscovered that their educational needs did not differ fundamentally from those of other Europeans. So, in time, may we. I hope it will not take 400 years. I hope it will not even take 40 years.

EDUCATIONAL ROLE OF THE CHURCH IN MEDIEVAL EUROPE

England throughout the Middle Ages had, of course, been as one with the rest of Europe, for the medieval church was the educator of all Christendom. The same church-managed universities and university-preparatory grammar schools were to be found on both sides of the channel. In England, too, the church had pursued her enlightened policy of seeking out talent no matter how humble its abode, and of educating poor scholars free of charge in return for entering her service. She did this because she understood better than the medieval civil governments that, to prosper, any organization must staff itself with able men. As the number of able men is never adequate to the need, the church disregarded the class prejudices of the times and sought out bright children, no matter what their social origin. Many talented poor boys got a good education at her grammar schools and universities. The cost of educating them was borne by direct church aid, by tithes, by endowments and other grants. One may properly say that the medieval church ran a European public school system for higher education.

The students nearly always became ecclesiastics. This gave the church a monopoly of Europe's professional talent. Since they had no separate educational facilities of their own, civil rulers had to make use of this talent; ecclesiastics filled the chief offices of state. Many, though well educated, were of humble origin. Trevelyan in his *History of England* notes that this was true of the Tudor monarchy's greatest public servants.

In medieval Europe there was no clear-cut distinction between spiritual and lay power. Both were in a sense corulers, though each felt that by rights the other should be subservient. In practice they compromised by agreeing that certain functions were properly those of the church and others the domain of the lay ruler. Education was clearly understood to be in the church's domain.

EUROPEAN EDUCATION AFTER THE REFORMATION

The church's European public school system went to pieces in the Reformation and the ensuing religious wars that tore Europe apart. Church property, including that devoted to education, was confiscated by all the Protestant princes, and education everywhere went into a decline. But on the Continent this was of relatively short duration for the educational responsibilities of the church were soon taken over by the secular power. In the 16th and 17th centuries there arose a group of centralized, absolutist monarchies whose rulers stepped into the role of the church. The transition from the church's European school system to the new national school systems went fairly smoothly. Many of the educational principles developed in the former lived on in the latter. This is why European school systems resemble one another so closely.

Whatever one may think of Renaissance princes, many of them were highly cultured men with a genuine interest in education. They promoted, financed, and regulated it, and they took over from the church the concept that talent wherever found should be sought out and nurtured through education. They did this for exactly the same reason that had motivated the church to do so. They faced the need for numerous professionally trained people to staff their centralized national administrations.

Because of the intense rivalry between Europe's many independent states and their incessant wars, intelligent rulers recognized, as had the church before them, that to prosper and survive they had to have competent people for their civil and military services. Children of the aristocracy did not at that time have a tradition of studying for the professions and becoming public servants. This had customarily been left to young men who had unaristocratic leanings toward book-learning and were willing to enter minor church orders. To fill the need for professional people, the princes turned to talented non-aristocratic children. They built up national school systems so that such children might obtain an education at nominal cost, or free on scholarship. In many cases confiscated church property was released by the princes and used to build new schools. Running expenses were met out of taxes, supplemented by fees from students who could afford them. Because Bible reading is so important a part of Protestantism, many devout rulers felt it their duty to provide all children with enough schooling so they could at least read. The first Prussian law commanding parents to send their children to school dates back to 1717. Some countries had such laws even earlier.

Such were the beginnings on the Continent of public school systems and of professionally staffed civil services. Both valued talent. Class barriers that normally kept children in the social class into which they had been born were lowered in the case of talent. In Prussia, for instance, entry into the civil service has been open to all classes for a century and a half—just about as long as that country has had a full public school system from first grade through graduate university.

ENGLISH EDUCATION AFTER THE REFORMATION

After a relatively brief setback, the Reformation led to educational progress in most continental nations. It was not so in England. There the Reformation set the country back educationally for centuries. Much of the medieval school system was destroyed by confiscation and little was done to make good the loss. It is estimated that for every new school founded in Tudor times 10 old ones were closed. Enormous damage was done to the medieval system of parish elementary schools while grammar schools declined in number by almost 50 percent during the quarter century between establishment of the Anglican Church and Elizabeth I's ascension to the throne. Medieval England had 1 grammar school for every 5,625 in the population; in 1558 she had 1 to 8,300; mid-Victorian England had 1 to 23,000 in the population. While two universities were ample for medieval England's 2½ million people, four were wholly inadequate for her mid-19th century population of 20 million. The Reformation ushered in a long era of educational stagnation and of retrogression relative to the Continent.

ENGLAND'S GOVERNMENT STRUCTURE AND TAX-SUPPORTED SCHOOLS

Political institutions were affected differently in England than on the Continent. In England the Reformation helped bring about parliamentary government; on the Continent it led to monarchial absolutism. In part, this was because the channel was broad enough to allow England to keep aloof from the Continent's ceaseless religious and dynastic wars. Not being under constant danger of attack made it easier for her to keep her own rulers in check. Absolutism triumphed elsewhere because executive power always grows when nations are at war, and the Continent was on a permanent war basis most of the time. England was fortunate in that she could decide for herself whether or not to participate in continental wars, and she did so only when she thought this essential to maintain a balance of power.

At the beginning of the 19th century most of Europe still had autocratic monarchs but England's King no longer ruled, he *reigned.* Parliament had become the all-powerful governing body. Strangely enough, England's early success in putting an end to royal pretensions of absolute power contributed to her relative backwardness educationally. For Parliament neither saw as clearly, nor recognized as early as the Continent's absolute monarchs, that a modern nation, to prosper, needs a tax-supported school system. Nor did Parliament accept as easily the idea that, to be assured of enough educated people, society must underwrite at least part of the cost of schools and universities; not even after it had become clearly evident that by depending wholly on private support of education, England would be unable to match the educational achievements of countries that had established publicly financed education systems.

The significant difference between private and public education is of course that in the latter case the cost is socialized. In other words, education is put on the same footing as other indispensable services provided by modern states out of general taxation. Just as the citizen who asks for and obtains police protection or who seeks his legal rights by recourse to the courts pays no special fees, so children in a public school system obtain education free of charge or at nominal rates. Far more children will become educated under these circumstances than when private and eleemosynary resources alone must defray the cost of schooling.

CHURCH AND STATE PROBLEM

Difficult as it was for Parliament to face up to the need for a public school system, it was even more difficult, once the need was accepted, for Parliament to set up such a system. For the prime requisite here is that the secular power be paramount in the field of education.

Because this was achieved at an early date in the absolute monarchies of continental Europe, establishment of public education could there go forward without serious interference by the churches. The English Constitution, however, had not yet reached a point in its evolution where education became undisputedly a secular matter. For historical reasons Parliament itself had vested great powers in the Established Church. She held the position of supremacy over all other churches in England. Adherence to her faith was a prerequisite for ascension to the throne. Nor could anyone be elected to Parliament or hold public office, until well into the 19th century, unless he was Anglican. Thus the largely non-Anglican middle class remained disenfranchised until the 1832 Reform Act.

Moreover, the church was permanently represented in the House of Lords and so was part of the country's supreme governing body—Parliament. She was closely identified with the Tory Party and she belonged to that powerful group in England called the Establishment. In some areas in fact she was virtual coruler with the secular government. Her hold on education was not easily broken since Parliament was in this matter divided against itself. During most of the 19th century its membership was Anglican and composed in large part of men who had themselves received their education in church-managed boarding schools and universities.

STRUGGLE FOR A PUBLIC EDUCATION SYSTEM

Eventually secular supremacy in education was achieved. A series of hard won parliamentary acts in the 1850's, 1860's, and 1870's reorganized church-controlled schools and universities, and commissions were set up to see that the reorganization was carried out. In this fashion, the education monopoly of the church was broken and the way paved for establishment of a state education system. But there were still further delays. In fact England did not set the stage for catching up with the Continent until the Education Act of 1944 made provision for an adequate system of public education.

Absolute monarchs can *decree* public education but Parliament can act only when there is public consensus that this step should be taken. This consensus was long in coming. England had for decades been divided by a violent and often passionately fought battle between diametrically opposed conceptions of education held by different sections of the English people. The cause for much of the bitterness in the educational debate was the Anglican Church's management of the endowed schools and universities. These preempted virtually the whole field of higher education in England, yet the church excluded from them all non-Anglicans—a substantial minority composed of Catholics and Dissenters. Not content with barring them from schools and universities under her control, the church tried for years to prevent non-Anglicans from setting up their own schools and universities, even at their own expense. She did this by claiming the exclusive right to license teachers, on the grounds that she was in direct episcopal succession to the medieval church which had possessed this licensing power. The Anglican Church refused to recognize as a teacher anyone who did not hold an Anglican episcopal license; she even tried to have them prosecuted. The church for years was also successful in holding up bestowal of a charter on the University of London which had been founded by Dissenters whose children were barred from Oxford and Cambridge because they refused to adhere to the Anglican faith.

The bitterness these church actions engendered among English Dissenters was aggravated by the fact that the religious schism coincided closely with the schism between the English upper and middle classes. Generally, the upper class and the Tory party were Anglican, while most Dissenters belonged to the middle class which until 1832 was disenfranchised and thus lacked the weapon of the vote to make its educational demands effective. After 1832 the dissent became stronger and the religious battle became fiercer. It was chiefly because of this acrimonious controversy that public education was slow in coming to England.

Not that there was a greater religious diversity among her people; England simply did not manage as well as most continental absolutist monarchies to keep the peace among them. It had not been possible to compel universal adherence to the Anglican Church, and religious heterogeneity had to be accepted. When this happened on the Continent, enlightened absolute monarchs usually followed the motto of one of Prussia's kings: "Let everyone attain salvation in his own fashion." In education this meant religious tolerance and subordination of warring churches to the secular power. Hence the relative ease with which continental countries secularized education and made it public.

In time Englishmen came to realize the advantage of tax-supported education, but they found it extremely difficult to accept extension of government into this new field of activity. This would in any event have been difficult for a people distrustful of big government. But the difficulty was made nearly insuperable by the emotions that had been aroused by decades of religious strife.

The Anglican Church opposed state education because she continued obstinately to claim sole right over education. The Dissenters opposed state education because they feared that no matter how carefully it might be hedged against clerical intrusion, any state system in England would end up being controlled by the Anglican Church. No one could agree on the question of religious instruction in state schools. The Dissenters would not accept the teaching of Anglican doctrine. One of their spokesmen, Owen Lancaster, proposed as early as 1807 that religious teaching be nondenominational, but the Anglican Church refused to give an inch. It was not possible for Englishmen to come together on the basis of a common Christianity until religion had lost some of its influence.

PRESENT STATE EDUCATION SYSTEM AND CHURCH-SPONSORED SCHOOLS

Today a nondenominational form of religious worship and teaching is part of the curriculum in all state schools. Parents may withdraw their children from these religious observations, if they wish. England now includes within her state education system schools affiliated with and in part financed by churches. All of them receive their running expenses from the Local Education Authorities who are represented on the governing boards of the schools. Depending on the size of church contribution to the cost of building and maintenance, the schools retain the right either to require that all teachers be of the same faith, or merely that a sufficient number be of that faith so that appropriate religious instruction can be provided. The teachers must, however, qualify under national standards and the curricula of church schools must be up to the scholastic standards required by the Local Education Authorities. Thus the long battle has come to an end. It has been remarked, that not until the English ceased being religiously devout were they able to be kind and tolerant to fellow Christians of a different faith.

In this respect we in this country have shown greater wisdom. The history of English education makes clear the desirability of keeping church and state separate in countries where the people are religiously heterogeneous.

LESSONS TO BE LEARNED FROM ENGLAND'S EDUCATION EXPERIENCE

I have told of these bygone controversies and problems, which may seem irrelevant to the present day crisis in American education, because they illustrate two important points. One is that we must beware of deluding ourselves that a politically advanced country will necessarily be ahead of a less advanced country in matters requiring public action. On the contrary. When people must be persuaded of the wisdom of governmental action, wide scope is given to selfish vested interests opposed to such action, not because they believe it to be against the national interest but because they know it is against their own group interest.

To manage a higher form of government requires great political skill. Even more, it calls for a higher degree of patriotism on the part of those who may have to relinquish special rights or change accustomed ways of doing things if the national interest is to prevail. This was lacking in the English church versus state and private versus public education dispute. It is lacking in our country, too, where necessary reforms are stalled by those whose personal or group interest is served by the status quo and for whom change would require effort or sacrifice.

The second point brought out by England's long struggle to secularize education and establish a public school system is the need to alter political practices when they prevent realization of an absolutely essential task. Government exists to serve the needs of the people. To argue that government may not legally do so makes no sense. I suppose there must have been Victorian gentlemen who knew that unless England became educationally competitive with the Continent, she would cease to be the premier nation of the world, but who felt it was hopeless to try to bring this about because the necessary action went counter to the English way of life; specifically to the traditional way of educating English children. In the end, Government took the action that was necessary, action that could not be taken by anyone *but* the Government.

I notice that some American standpatters have come up with a new gimmick to prevent needed reform. They say the critics of our school system overlook the fact it was deliberately set up to be different from school systems in Europe, no matter how much more efficient these might be. Historically this is not correct. The progressive educationists, not the American people, decided we should have life-adjustment training, permissive schools, automatic promotion, unmerited diplomas, and so forth, instead of basic education. It is these and other progressive features that chiefly distinguish American from European education, and that make it virtually impossible for our schools to do their technical task properly. I am not aware that the educationists ever received a clear mandate from the American people to keep our schools scholastically inferior in order to make them more "democratic."

Even at the height of the progressive movement, in the 1940's, an elaborate survey showed that nearly half the respondents desired modifications in curriculum and method decidedly *unprogressive* in character. And the higher the education of the respondents the greater was the desire for changes.

In this connection it is interesting to note that where private progressive schools were established, the clientele was overwhelmingly middle class; the working class was not as a rule willing to participate in radical pedagogical innovations. Caroline Ware in *Greenwich Village, 1920–30* reports the following remarks of an Italian resident of the Village concerning a local progressive experiment: "The program of that school is suited to the children of well-to-do homes, not to our children. We send our children to school for what we cannot give them ourselves—grammar and drill—we do not send our children to school for group activity; they get plenty of that in the street."

ROLE OF THE FEDERAL GOVERNMENT

As to the question whether the Federal Government may aid education, it seems to me if the people wish it to do so, there is nothing in our form of government to prevent greater assistance from Washington. I note that last year's amendment to the Water Pollution Act of 1956 carries Federal aid a remarkably long way under the "navigable waters" and "interstate commerce" clauses of the Constitution. If requested by a State, the Federal Government is now authorized to research and develop new methods of pollution control and to award grants-in-aid to localities and States using these methods. This is no different than for a national committee to set up scholastic standards which schools may or may not adopt but which would earn them Federal accreditation. It seems to me the Pollution Act precedent would even allow the Government to make special grants to schools that accepted the commission's national scholatic standard.

Free people can always find a way to solve urgent national problems, but they must harden themselves to the cries of defenders of the status quo. Often these are ingenious people. Their command and use of illusions, slogans, and cliches are impressive. But back of it all is their own naked self-interest. When this interferes with the national interest, it must be made to yield. All progress hurts some people but this is no reason why we must stand still.

English education history should teach us the lesson that a consensus country can easily be outstripped by a decree country if its people are complacent or if their vision has been blurred by the clever propaganda of those who care more for their own interest than for the good of the country. The consequences of delay are never slow in coming. In but 16 years, between 1851 and 1867, England lost her unquestioned industrial superiority. We too have lost technological supremacy in certain highly important items, and virtually overnight. So frighteningly fast can supremacy, when it lacks educational foundation, be lost! The top is a slippery place.

England's position at the end of the Napoleonic Wars was similar to ours at the end of World War II. Militarily, politically, economically, England then stood at the pinnacle of power. Contrast her position with that of her ally in the war, but soon to become her competitor—Prussia, a poorly endowed agrarian country, but recently devastated by a lost war, a foreign occupation, and a confiscatory war debt—a country far behind England in everything *but* education. Yet education sufficed Prussia to catch up and then pass England industrially and in the end militarily—all in a surprisingly short period of time.

In Prussia educational reform had been *commanded* by an autocratic king who yet was deeply concerned with his people's welfare and who had outstanding advisers to help him take measures that would make his country great. Consider that it took but *1 year* for Humboldt wholly to alter the pattern of German secondary and university education; that in the midst of the direst poverty and an empty public treasury, the king decided to found a great modern university. And contrast this with the endless arguments, inquiries, reports, and recommendations that were needed to sweep away but a few of the worst features of English university life; or with the century-long battle to give English children as good an elementary education as children on the Continent enjoyed.

I stress the parallelism between 19th century English and 20th century American educational inadequacies because to me it makes sense that we should profit from English experience. It seems to me particularly important that we take note of the striking similarity between Prussian education reform in 1806 and Russian education reform in 1945; England took no note of the first and we do not sufficiently realize the significance of the second. It is an unintelligent sort of partiotism that dismisses major education efforts of another country on the grounds that the country concerned pursues wicked political objectives. All the more important, this being so, that we do not permit them to outpace us in education. I recommend we take to heart the words of C. P. Snow, spoken on the occasion of his induction as rector of St. Andrews University in Scotland in the spring of 1962.

After reminding his compatriots that the Russians had suffered casualties * * * "on a scale which no great country has ever suffered," having lost 1 in 10 of every Russian man, woman, and child in the country, killed in battle, by starvation, and other war-connected ways, Snow asks how many Englishmen are aware that in 1945—

> immediately after this apocalyptic experience, the Soviet Union, as its first task, threw its creative energy into education? Education, which in depth and width, leaves us standing.

As a result of this effort, "we have already seen some spectacular by-products whizzing round in space," and, he predicted, "we shall inevitably see more remarkable results than these."

In our country it was engineers and scientists who first drew attention to the Russian educational challenge; our educators hadn't noticed a thing. They called me "hysterical" when I warned of the Russian education danger in 1956 and, even after sputnik underlined my remarks, leading educators still rejected the very idea that Russian scientific successes were sufficient reason why we should examine her education system. I read in the papers that we are now translating

Russian mathematics textbooks for use of our schoolchildren. This I think is a devastating commentary on American public education and all the boasting of its allegedly scientific teaching methods and superior insight in the "learning process".

As citizens of self-governing, politically free societies, Englishmen and Americans, before giving approval to radically new government activities, have to be persuaded they are necessary and advisable. Neither of us likes to see government expand, to take over responsibilities that used to be private. The necessities of civilized life are nevertheless driving both of us inexorably in the direction of more government, more and more socialization of the cost of services that once were private and must now be public. Though driven toward government expansion, neither England nor the United States will move until a public consensus has developed that such a move should be made. This is what we mean by liberty; this is what makes the air we breathe so free. But this also puts us at a disadvantage when we are challenged by countries that are able to act faster than we.

EDUCATION HAMPERED BY EMPHASIS ON NONEDUCATIONAL PURPOSES

The cause of good education was additionally hampered in England, and it is additionally hampered in the United States because we look upon schools as agencies performing not only strictly educational tasks but serving noneducational purposes as well. Nineteenth century England gave an extraordinary amount of thought to matching schools with particular social classes. American progressives put equal effort into making our public schools agencies for eliminating social classes. The extraneous objective in England was of course the very opposite of the extraneous objective in this country, but the bad effect on education was the same.

Education always suffers when it takes second place to other uses the schools are made to serve. It matters not whether these uses be, as in 19th century England, preservation of an existing class system or as in our country today, elimination of differences in intellectual ability and home background of children. We have no trouble recognizing how damaging was the English notion that schools should be socially homogeneous, yet we seem impervious to the damage done our own schools because of their being used as engines of intellectual egalitarianism instead of as places where knowledge is transmitted and young minds are developed in the best way this can technically be done.

THE NEED TO NURTURE AND EDUCATE TALENT

Under Anglican management, English higher education retained many outward features of medieval education—academic garb for students and teachers, the requirement that university tutors must be in clerical orders, etc.—but the inner spirit changed radically. The church thought of herself as educator of the children of the upper classes who in England provided the pool from which nearly all leaders in public and private life were recruited. She did not think of herself as the educator of all whose talent would enable them to *become* outstanding leaders, as had the medieval church. What was lost in Anglican schools and universities—or very nearly lost, though there were a few exceptions—was the great principle of medieval education that talent, wherever found, is precious and should be sought out and educated free of charge. England's endowed institutions had been set up for the express purpose of providing free education for talented "poor scholars." But by the end of the 18th century, "foundation scholars" were being eased out, and schools sought to make themselves socially exclusive institutions.

John Erskine once wrote a piece on "The Moral Obligation to be Intelligent," in which he raised the question: In the "reckoning up of our spiritual goods," in the "list of our genuine admirations, will intelligence be one of them"? His answer was that neither in the United States nor in England has intelligence been given its proper value and esteem. It is strange that the old European tradition that talent must be nurtured and educated was respected as little in 19th century England's socially exclusive schools as it is today in American schools where social leveling takes precedence over education that develops the mind.

EXCLUSIVE NATURE OF THE 19TH CENTURY ENGLISH SCHOOLS

One has to immerse himself in the writings of England's 19th century economists and political scientists, in legal and administrative rulings, in reports of Royal Commissions of Inquiry to understand how strong was the English conviction that schools ought to restrict themselves to the needs of a particular class. Oddly enough, many people, especially writers, actually believed that men had "an equal degree of intelligence." But this was a theoretical conviction. Well-situated Englishmen seem to have felt that classes were unavoidable; that it had pleased Providence so to arrange matters that a few children were born to privileged and wealth, hence could be educated, since their fathers could pay the school fees. The majority were born to be put to work at an early age and so lacked the time to become educated. Universal elementary education could not come until English society had reached a consensus that exploitation of child labor by industrialists should no longer be tolerated. England was slow in reaching that consensus too.

But many well-to-do people were concerned that children forced early into factory and mine were growing up to be little heathens. So began the Sunday School Movement—a private charitable undertaking. The men and women who established Sunday schools were kindly people who gave much time and money to the cause. Yet even among them you find a strange conviction that children should be taught only what was appropriate "to their station in life." A noted philanthropist—Hannah More—felt they needed to learn to read so they could read the Bible, but that they did not need to be taught to write. "I will allow of no writing for the poor" declared the lady firmly.

A legal decision that strikes modern Americans as curious was the famous judgment of Lord Eldon against expansion of the curriculums of England's academic secondary day schools—the Grammar Schools. The court declared that the proper curriculum for a "grammar" school was to "teach the learned languages," Latin and Greek, and that to introduce mathematics into the curriculum was contrary to the statutes and illegal. Equally odd to us are administrative rulings forbidding local school boards to provide for the teaching of French in local schools. The boards were responsible for elementary education and it was held that to include a foreign language in their curriculums went beyond what was proper for an elementary school.

The same class conception of education permeates the reports of Royal Commissions charged with inquiring into the educational performance of endowed secondary schools, especially the commissions reporting during the two decades from 1850–70. Parliament considered itself competent to investigate these private schools because they had been established by royal charter and were therefore held to be national institutions—a principle which, incidentally, goes contrary to *our* own legal conceptions, as in the *Dartmouth College* case.

I mentioned before that the original endowments had been made for the express purpose of educating poor scholars, often boys of a particular locality. Although the commissions did good work in bringing about a gradual improvement in the curriculums of these schools, they fully approved of the practice of keeping poor boys out. What strikes an American as quite incomprehensible is that all these highly intelligent, liberal, and humane Victorian gentlemen could be so obsessed with preserving the social exclusiveness of schools that they favored legal abolition of the ancient foundation rights of local boys and awarding of endowed free places on the basis of nationwide competitions. Workers' children were thus effectively barred, for they had no access to the necessary preparatory education. In this manner the exclusive atmosphere of the schools was safeguarded against the "undesirable" presence of poor boys!

In secondary education there existed a clearly defined hierarchy. The most socially exclusive schools were the expensive boarding schools, called "public" schools—Eton, Winchester, Harrow, etc. Just below stood the less expensive day schools, called "grammar schools," The "public" schools, often called the "cradle of English statesmen" were for the aristocracy; the grammar schools for the upper ranks of the middle class-managers, professional people, etc. In 1868 a Commission of Inquiry charged with investigating the endowed grammar schools proposed that two new types of secondary school be created to cater to two lower rungs of the middle class. Lord Harrowby expressed the idea as follows:

> I should like to say, you shall be a good lower middle-class school; you shall be a middle middle-class school; and you shall be a higher middle-class school, that which is now called a grammar school.

As envisaged by the Commission, class exclusiveness would automatically be preserved by prescribing length and cost of schooling. The three school types were to terminate at ages 18, 16, and 14 and were to cost from $600 down to $6 per annum, respectively. This scheme was never carried out because England was not yet ready to set up a state system of secondary education. When she finally did, these odd class notions no longer prevailed.

IS SEPARATE SECONDARY SCHOOLING UNDEMOCRATIC?

I have mentioned all this not in a spirit of criticism but to emphasize my assertion that school reform is hampered when a *social* task is imposed on the school which takes precedence over the *technical* task. We have no trouble recognizing this in the case of English education but we don't see that when American educationists attack separate secondary schooling as undemocratic, when they indignantly declare that we will not "maintain at public expense separate schools for any sort of elite," they too are rejecting technically efficient education on social or political grounds. Obsession with extreme egalitarianism is as destructive of good education as is obsession with extreme class snobbery.

We can match Lord Harrowby's quaintly hierarchical views on English education with the quaint egalitarianism of an American educator like Seymour Lipset. In discussing English education he states that what he calls the "lower strata" are "not particularly interested in paying for more education, either personally or through higher taxes." As dropout figures in both American and British free secondary schools show, they are often unwilling to stick to schooling for the time it takes to become genuinely educated.

Professor Lipset's solution seems a bit drastic. "To really democratize the class structure," he wrote, "it may be necessary to reduce the level of education which middle and upper class British youths receive before reaching the university." One might reply that this would inevitably lower the academic worth of the university and put England at a great disadvantage vis-a-vis continental countries. Unless, of course, Professor Lipset could persuade them to do likewise. "Is this too great a price to pay for an open and equalitarian society?" he asks. I fear I must answer that I think it is.

Separate secondary schooling as practiced abroad today has nothing to do with class differences. It does have to do with differences in academic ability. Class differences have no significance for genuine education; they are artificial differences that do not touch upon a person's ability to learn. Intellectual differences are of vital import to genuine education; they are real, they determine what *can* be learned. You cannot have secondary education—in the sense of "higher general education" that it is given everywhere except in the United States—you cannot have it unless children are grouped according to whether they can or cannot absorb academic subjects.

The deep-seated conviction among many Americans that all European education is class education may well be rooted in actual conditions that existed in 19th century England. We are more familiar with England than with the Continent. We tend to assume that what she does is general European practice. But nothing quite like the class division in English education existed on the Continent, where the people had fewer political liberties but where they had a more equal educational chance in their state school systems. Of course, the English have long since abandoned the absurd notion that schools should be *socially* homogeneous. We have yet to abandon the equally absurd notion that schools may not under any circumstances be *intellectually* homogeneous.

A consensus country is always at a disadvantage when it competes with a decree country in matters requiring prompt action. Obviously, we cannot for a moment consider abandoning the principle of progress by consent. What we might be able to do, however, is to try and speed things by ceaselessly hammering at public apathy, by presenting the need for action as persuasively as we know how, and by holding to public account every vested interest group that delays progress by putting its own preference for the status quo above the Nation's needs.

THE DANGER OF TAKING WEALTH AND POWER FOR GRANTED: ENGLAND AND THE UNITED STATES

Among the causes of English procrastination a century ago and of ours today, most important probably is sheer unbelief that the schools could really be as bad as critics and would-be reformers assert. The English found it particularly hard to believe that a German state, Prussia, could be superior to England in *anything*. They looked down on Germany which they regarded as poor, industrially backward, and politically undeveloped. This had been true at the turn of the 19th century. But while the English were busy in other activities, the Germans educated themselves and presently they were making things tough for English traders and merchants all over the globe. Further, their navy was beginning to challenge the English navy. Just so have we been looking down on the Soviet Union, so clearly inferior to us in wealth, industry, and social structure. We find it hard to believe she could do *anything* better than we. But for some years now our industrial growth rate has been smaller than that of either Russia or Europe.

With the evidence of wealth and power all around them, Victorian Englishmen felt secure and confident. And so do we today. That we have the highest standard of living seems clear proof to most Americans that we are not only the wealthiest and the most powerful nation on earth but also the cleverest; that we do everything better than anybody else. Why then worry about education? We have prospered beyond human imagination with an educational system that at no time was scholastically the equal to Europe's. Like England, we have not counted education among our acknowledged national priorities. England's Minister of Education recently said:

> This was perhaps not so reprehensible as it would seem to us today. The British had invented the Industrial Revolution, built a great empire, and kept the peace and all with only a rudimentary system of public education, a massive neglect of science, and a tiny university provision.

Affluence brought with it a complacent sense of superiority.

> Never did people believe anything more firmly—

wrote Matthew Arnold a century ago—

> than 9 Englishmen out of 10 at the present day believe that our greatness and welfare are *proved* by our being so very rich.

How contemporary, how *American* these statements sound!

England and the United States are unique among leading powers in having reached top position in the world without being educationally competitive with nations they passed by on the way up. England's rapid rise was largely a consequence of her possessing the secrets that had brought about the Industrial Revolution; these gave her an enormous economic headstart over the Continent. Soon she came to take her industrial supremacy for granted as if it were but a natural consequence of innate English superiority. Just so are we presently taking our wealth and power for granted as if they were but a natural consequence of innate American superiority.

SUPERIOR EDUCATION NOT NECESSARY AT FIRST

In truth, both England and we had not a little luck on our side. We both benefited greatly by being geographically distant from the world center of conflict—then as now continental Europe. This allowed us to concentrate on domestic problems and to take our political security as a matter of course. We both reached the top partly by luck, but also by our pronounced practical genius. This is a human quality which, before the advent of the scientific revolution did not depend on superior education. Our peoples have therefore tended to look on "book learning" and on scholars with less respect than do the continental Europeans who have had to develop their inner resources because they had less inclination or opportunity to expand outward. They also had to keep their education systems up to par and their wits sharpened, for nearly all their foreign contacts were with other Europeans, equal to them in culture, education, and political *savoir-faire.* This may well have had something to do, also, with the high professional caliber of European civil servants. No country could have afforded to put a businessman untrained in diplomacy into an important ambassadorial post when his colleagues were highly competent diplomats. We do this constantly.

England in her trading ventures abroad, the United States in her conquest of the Indians, were dealing with peoples far more primitive than Europeans, peoples who lacked the science and technology Europe had developed over many centuries. Average Englishmen and average Americans were easily the superiors of these people in distant lands. Not nearly so much education was therefore needed to be highly successful. We colonized our vast continent, the British colonized an even larger area. Since in our case conquest encompassed a contiguous land area from which the native population could be removed, our gain was permanent. England's conquests were overseas and often did not involve massive settlement by Englishmen, but instead left the native population in possession of the land. In consequence she lost her empire. But while it lasted, the size of the territory she controlled allowed English practicality the same scope that the size of our own huge land gave us.

NATIONAL PROMINENCE DELUSIVE

Being citizens of a large country gives people a lift and a certain cockiness. They do not take kindly to the idea that other, less important countries, might do some things better and that it might be wise to follow suit. Only a minority of farsighted Englishmen saw, early in the last century, that an empire lacking the firm foundation of a first-rate education system was built insecurely. It took the rest of the British people a long time to come to the same conclusion. Among these farsighted men was an adopted Englishman, Prince Albert, consort of Queen Victoria. A well-educated continental himself, he was appalled at the low standards of English education and the inadequacy of her educational facilities. As early as 1851, he warned that—

> the improvement in locomotion, the increased means offered by science for the extraction, preparation, or culture of the raw material, have lessened the peculiar local advantages of certain nations. * * * While *they have immensely increased the value of skill and intelligence as the other great element of production.* The nations most likely to afford a public recognition of this fact are those whose fuel and raw materials are chiefly derived from other lands, and who can therefore only carry on a successful competition by continually economizing and perfecting production by the application of science.

English reaction to this tactful warning was that the prince spoke as he did because he was a German and that—

> popular education was a fad—fit perhaps for industrious foreigners in Central Europe who had not our other advantages of character and world position.

The sense of superiority of insular Britain comes through dramatically in the oft-quoted weather report: "Fog over channel, Continent isolated."

Englishmen who sought to awaken their country to the danger of competition from better educated Prussians and other continentals were often accused of being "Prussia lovers"—just as critics in this country who point to the danger of Soviet education are called "Russia-lovers." Chauvinism muddles thinking about education. Pride is hurt when it encounters the truth. As Goethe said, "It is the truth, but not for us."

I do not want our country to lose the supremacy we still possess because we were the first nation to apply modern technology to an area of continental size. The immensity of our territory and our great wealth in minerals and fuels gave us this head start. But now we face Russia—larger in land area and quite as rich in natural resources. We also face a united Europe which is finally creating the conditions that will allow her to obtain full benefit from modern technology through a Common Market of continental size. Much of the science on which modern technology is based was invented by Europe, but political fragmentation in the past kept her from making full use of her inventiveness.

Our rivals are now busy applying technology to large trading areas. With the bases of industrial power equalized, relative levels of educated manpower become the decisive factor. Russia and Europe set a higher value than we on intellectual excellence. The Russians are educating more professionals and more technicians in all areas that affect a nation's power position. On the Continent and in England, government, industry, and educational institutions are jointly making great efforts to improve and increase technical manpower. If we hesitate much longer in upgrading the scholastic standards of American education, we face a difficult future.

PROCESSES OF REFORM IN ENGLISH EDUCATION

Mr. Cannon. Admiral, do you feel that we in this country can profit from the manner in which the English finally solved their educational problem? Would you explain how the organizations, the structure of English education differs from our school system?

Admiral Rickover. Compared to other European public school systems, the structure of English education at first sight looks incredibly complex, planless, and without order. This is because it was not decreed, or set up by government fiat, but evolved slowly, as public consensus was formed and brought forth parliamentary action. In this manner it resembles the English Constitution. England's Government does not rest upon a basic document, as ours does on the Constitution. It evolved through slow accretion of legislative enactments, court decisions, customs and practices which gradually transformed the Government.

In rough outline, there was first the long drawn out battle to establish parliamentary supremacy over the monarch. This was begun under the Tudors and essentially completed in 1688. Parliament is legally omnipotent, the King reigns. Then there was the battle to establish the supremacy of the House of Commons over the House of Lords, which appears to be pretty well accomplished now. Throughout the 19th century, as I have tried to show, the question of state versus church control of education was a public issue of greatest importance. By the end of the century, the secular power had attained paramountcy in education and it was possible to set up a state education system.

England's transformation from a parliamentary aristocracy with a small electorate into a parliamentary democracy with universal manhood and womanhood suffrage came also by slow stages. It began with the 1832 Reform Act, followed by a series of acts enfranchising one segment of the population after another, until all vestiges of *political* class privilege had disappeared. The English completed this evolution in 1918, at the same time that we rounded out our own democratic growth by granting American women the vote. Expansion of the suffrage paralleled expansion of government into the realm of education. This is natural since it was through political power that the educationally deprived classes—first the middle class, then the working class—were able to obtain publicly financed schooling for their children.

EDUCATIONAL REFORM THROUGH PUBLIC DEMAND

Effective action to improve American education will not come until public consensus demands it. In the United States as in England, formation of consensus is held up until opposing viewpoints can be reconciled. Progress was made in England, as it will have to be made here, by compromise. For the most part compromise was reached under pressure rather than as a result of any genuine meeting of minds among the antagonists. Or, to put it differently, there was a meeting of minds only to the extent that both sides finally saw quite clearly that the status quo was no longer tenable. Since neither side could win a clear-cut victory over the other, compromise was the only solution. Out of many small compromises there finally evolved England's present-day system of public education.

THE ENGLISH COMMISSION SYSTEM

As I have brought out there was a very deep schism in English public opinion on the desirability of government expansion into the field of education. The manner in which agreement was finally reached resembles the manner in which we in this country reach consensus. The existence of a problem—in this case inadequate education—is brought to the attention of the people by public-spirited citizens. Their criticism of the status quo starts a national debate going. Efforts are made to remedy the situation by private action. Only when it demonstrably cannot so be rectified, will there be demand for public action. Pressure will then be put on Parliament by those who want to alter the status quo; opposite pressure will be put on Parliament by those who want to retain the status quo. Sometimes necessary action is held up because the latter wield greater political power than the former—as was the case with education in 19th century England. But if the problem is serious and the public is thoroughly aroused, Parliament will set up a Commission of Inquiry and charge it with looking into the problem, making a report on the true facts, and submitting recommendation for parliamentary action. Men of proven stature and knowledge are appointed to the commission.

In much the same way as do our congressional committees, a royal commission holds hearings where all sides are heard. It also, on its own, looks for accurate information. This may take several years. Eventually the commission makes a report to Parliament. The report is given wide publicity and much discussion in and out of Parliament ensues.

IMPACT OF COMMISSION REPORTS

I believe these commission reports have a greater impact on the general public because they do not merely give the facts as these are brought out in public hearings; they also contain a long and closely reasoned "opinion" of the commission together with specific recommendations. The reports carry the name of the chairman of the commission and are thus more easily identified in the public mind than are hearings of our congressional committees. Some of these reports become bestsellers. Everyone knows about them. They can be purchased at nominal cost from Her Majesty's Stationery Office. Among important education reports, I should like to mention the recent Crowther report—a veritable gold mine of information on the present status of English education; also the Bryce, Hadow, and Spens reports which led to inclusion of secondary education in the English state system.

It seems to me we might give thought to these aspects of England's commission reports. Anything that helps to make the public more interested in our education problem will tend to speed up the slow process of consensus formation in our country. Something is to be said for having eminent and trusted men, acting in an official capacity, disclose the true state of affairs in our public school system. There is at present so much muddling of the facts and issues, so many cliché screens are being set up to hide the real facts from the people, that something on the order of English Commission of Inquiry reports may be just what we need. I see no reason why the Federal Government should not act to shed more light on our education problem.

If a commission report meets with public approval, Parliament may enact a law incorporating some or all of the commission's recommendations. When necessary, Parliament will establish an ad hoc commission to see that the requirements of this new law are met; or it will entrust the task to a permanent body which may or may not already exist. For example, Parliament set up ad hoc commissions to see to it that the changes in the organization of endowed schools and universities required by new laws were duly carried out by these institutions. When Parliament took the first step toward eventual state education by making grants to private church schools, it entrusted the awarding of these grants to a committee of the Privy Council. As subsequent legislation expanded government activities in this field, the committee was transformed first into a permanent Board of Education and finally, in 1944, into a Ministry of Education with a Parliamentary Secretary. All previous ad hoc bodies dealing with primary, secondary, or so-called "further education," were merged in the new Ministry. Only government grants to universities remain outside its jurisdiction, being entrusted to a permanent committee of the Exchequer, called the University Grants Committee.

MINISTRY OF EDUCATION'S ACTIVE ROLE

Lay criticism played a most important role in this process of consensus formation. This is necessarily so in consensus countries because the impetus for government action comes chiefly from the people. As the English put it, the constitution is not the source but the consequence of individual rights. England has perhaps more ministerial direction than we have. The ministries often take the initiative in proposing new governmental action which then goes through the same process of consensus formation as when the original instigator is a lay critic. At the moment, the Ministry of Education is extremely active in seeking to get industry, the schools, the teachers, and the universities together on a vast program of expansion of technical education. England is clearly deficient in this field but under the intelligent leadership of the Ministry she is moving ahead rapidly.

One fruit of the efforts of the Ministry has been expansion of post-secondary school technical education on released time, especially for apprentices. Another has been creation of a new academic degree designed to raise the prestige of technology in a country where the brightest youth still tend to go in for an "Arts" Honors degree—"classical languages," or "philosophy, political science, and economics." The new degree is of Honors standard and is called Diploma in Technology—an American *graduate* science or engineering degree would be its nearest equivalent.

IMPORTANCE OF LAY CRITICISM

But the chief credit for having started England on the road to better education belongs to individual critics. There were families in England where each generation furnished a critic or school reformer—notably the Arnold family. Thomas, the father, reformed the famous private boarding schools that in England are called "public" schools, by evolving a "public school code" which subsequently was adopted by all these schools. Through this code he attempted to gentle the boys who were destined to become England's leaders, to give them a sense of civic responsibility, to make them more considerate toward the people they would lead. He also sought to make them effective leaders by placing great stress on physical fitness and by holding them to a more rigorous course of academic studies than had been customary before he became head of Rugby.

Matthew, his son, was an indefatigable critic who pricked English complacency and self-satisfaction by producing one carefully documented survey of continental education after another, each demonstrating how "uneducated" the English were compared to the people on the Continent. He continuously annoyed his countrymen by warning them that those better educated continentals were bound to make it more and more difficult for England to hold on to her industrial and political supremacy. Like modern-day American critics he had little impact on his complacent and affluent countrymen. But when at last England awoke, his books became classics.

Matthew's brother-in-law Forster was the member of Parliament who did more than anyone else to push through Parliament the first state education act—the 1870 act. How he won against last-ditch opponents who did not hesitate to heap calumny on him personally in order to defeat his bill—the 30-hour day-and-night session before the bill was finally brought to a vote—makes a dramatic story of the winning of a legislative battle against almost insuperable odds. Arnold senior's grandson, Arnold-Forster, wrote profusely on education and actively promoted its cause as a member of Parliament.

By the labors of farseeing individuals, by public discussion, by the slow evolution of public demand for inquiry, and eventually for legislation, England brought about improvement in her education. Although people with a vested interest in the status quo always heartily dislike critics, there is, I think, in England a clearer public perception of the crucial role the individual critic plays in the democratic process. And although the English share our preference for private over government action, they more readily face up to the need for public action when problems simply cannot be remedied by private effort. Long overdue reforms at Oxford and Cambridge, for instance, were hopelessly mired in the 1850's by reactionary churchmen who controlled the administrative machinery of these universities; only government intervention could overcome their determined opposition. In 1848, writing to Roundell Palmer, a Member of Parliament, Jowett, later famous as Master of Balliol College, made it clear that internal efforts were not enough—"It is nobody's fault—we cannot reform ourselves." Similarly, despite heroic efforts, voluntary church schools could not provide English children with the education they needed and which continental children received in state schools. Much as they disliked state education, the English accepted it as the only remedy that could solve their education problem.

OUTSIDE PRESSURES AND EXAMPLES AS SPURS TO REFORM

Outside pressure will provide the spur to produce consensus in our own country, as was the case in England. There is nothing objectionable in being motivated by the fear that unless reforms are made our country may be in danger. To deprecate this, as many educationists are doing, misreads the democratic process. Some urgent need is always required before a democracy will act. At the present moment the urgent need is to improve our education, so our country can remain prosperous and free and able to meet the political challenge of the totalitarian countries and the economic challenge of our friends and allies in a Europe that is becoming powerful by uniting itself.

Let us not forget that we gave Europe the impetus to unite and the material aid that is making her the economic power she has now become. A little reverse aid in the form of useful European ideas on education would seem quite in order. Let me quote from the preface to the English translation of Victor Cousin's *Public Instruction in Prussia*, which appeared in 1834. The English translator felt his compatriots might well profit from a study of Prussian education, even as the original French author, Cousin, believed Frenchmen might well consider adopting Prussian education ideas. The preface goes on to say:

> It is almost humiliating to have to notice another objection to this scheme of national education, * * * viz, that it is foreign; an objection which, if carried through and acted upon consistently, would render the intercourse between civilized nations absolutely barren.

It seems to me particularly important that consensus countries profit from each other's experience since they need all the help they can find to speed the process and act with dispatch, while always holding fast to the basic principle that government may act only when the people desire it to act. As we observe the difficulties that beset the English in reaching consensus on education, we see more clearly our own difficulties and this may help us overcome them. Then, too, the English predilection for conserving what is good, no matter how old it may be, and for moving forward by remedying defects piecemeal rather than by setting up entirely new schemes gives her system of education the same flexibility and adaptability to changing needs of changing times that characterizes her political constitution. This manner of progressing is in our own tradition. We can, therefore, more easily profit by procedures England has worked out in her school system than we could from symmetrical but centrally imposed foreign school systems. Take the manner in which her state education system has evolved. There is much we can learn from that.

EVOLUTION OF ENGLAND'S EDUCATION SYSTEM

When England realized that the voluntary church bodies could not build enough schools to fill the need, Parliament, through annual grants, came to their aid. When even these grants did not suffice to enable the church bodies to provide an elementary school place for every child, the government filled the educational void by setting up a mixed state and private school system. The voluntary or church-managed schools were not abolished; they continued to receive grants-in-aid. To supplement them in places where no schools existed, a state education system managed by locally elected school boards was established. Like ourselves, England discovered she had too many school boards; they were serving communities that were too small to provide the necessary lay talent that would make the boards effective. We still retain the multiplicity of local school boards but England abandoned this ineffective governmental unit more than half a century ago.

BOROUGH AND COUNTY COUNCILS

She made a new governmental unit responsible for state education. This was the Borough or County Council created by act of Parliament in 1888. A locally elected legislative and executive governing body, the English Council has jurisdiction over a much larger area than that covered by the former school boards. England thus reduced the number of school districts from 2,500 to 146. Naturally, since they now extend over a larger area the new school districts can draw lay talent from a larger pool and this guarantees more intelligent public supervision of state education. We still have over 33,000 school districts. On a per capita basis, this is three and a half times more districts than England had previously and 53 times more than she has now.

By parliamentary legislation in 1899 and 1902, management of state education in each community was made the responsibility of committees of the council governments, enlarged by addition of capable and experienced laymen as comembers. These committees are called Local Education Authorities or LEA's. They function in much the same manner as do other departments of the councils, such as those responsible for public housing, for highways, police and fire services, for public health and transportation, and so forth; for all the many public services upon which English citizens depend and which are paid for by local taxes supplemented by special government grants coming out of national taxation.

CENTRAL-LOCAL GOVERNMENT RELATIONS IN EDUCATION

It has been said that the merit of the special grant system—a distinguishing mark of English central-local government relations—is that it adds the good sense of the central authority to that of the local electorate in determining new services which necessarily involve control over local citizens and the power to raise taxes. Administratively, the Ministry in London is superior to the local council department, but through its members in Parliament the local communities exercise political control over the Ministry, since the Ministry is of course subject to Parliament.

To the English this system appears to safeguard control by the citizens, while making for great efficiency. Efficiency is further guaranteed by the very high professional standards of English civil servants. In our own country public attitudes have made it harder to professionalize public administration. In our thinking there are still remnants of Jacksonian egalitarianism that incline us to feel that patronage is "democratic" while professional qualification for civil service smacks of bureaucratic control. The Jacksonians felt that if professional qualifications were set too high, they would keep average Americans from getting a fair share of available government jobs. This was considered more important than that public servants should do their work well.

The English system of public education is managed, supervised, and kept up to standard in much the same way as other public services the state provides out of tax income. Since 1944, England has had a Ministry of Education empowered to "direct and control" the state school system. Previously she had a central Board of Education empowered only "to superintend." On paper the Ministry looks like the ministry of a country with a completely centralized system of education, but in reality it rarely issues an order down the line. The Minister establishes no school, draws up no curriculum, hires no teacher, gives no examination—notably not the "11-plus exam"—and awards no diploma or degree. Central-local government relation in education, as in nearly all other fields, is one of partnership.

Thus the day-to-day management of the state education system in a given community is in the hands of committees of the locally elected council government, the Local Education Authorities.

EDUCATION STANDARDS FORMULATED COOPERATIVELY

The standards by which the LEA's are governed in this work, while for the most part national, have been formulated cooperatively by the Ministry, the Local Education Authorities, and the teachers. Through their national associations, the teachers are the third force in this setting of national education standards. Normally, the initiative in this matter rests with the local element in this copartnership. The Ministry accepts, advises, or objects to their plans. Sometimes the Ministry indicates that a certain matter requires action and asks the

LEA's to submit a plan. The 1944 act which greatly enlarged the responsibilities of the LEA's also required them to submit for the minister's approval a development plan for primary, secondary, and "further" education. By 1950 all LEA's had submitted such plans and over half of these plans had been approved.

SOURCES OF FINANCIAL SUPPORT FOR EDUCATION

Overall, English local government derives only about half its income from special government grants, but in education the national contribution is 70 percent. Since grants are adjusted to local requirements, they will constitute a higher percentage in some areas than in others; in this manner geographic inequalities are evened out. As I will presently describe, education grants traditionally have been made contingent on acceptance of national standards and of the permanent right of the national education authority—now the Ministry of Education—to inspect schools to determine whether the national standard is being met. In this manner the ministry makes certain that its special education grants are used for the purpose for which they were given.

ENGLAND'S GOVERNMENT STRUCTURE AND OURS

England, a small, compact, homogeneous country has a unitary government, while we in accordance with our history and continental size appropriately have a government in which sovereignty is divided between the Federal and the several State Governments. Not everything done in England to advance education can therefore be done by our Federal Government. Much that Parliament can do is here possible only by State action. While England therefore does not have a Federal versus State problem in education, she shares our preference for decentralization in management of schools. She does not, however, share our dislike of national scholastic standards. These she manages to provide by procedures that are persuasive rather than regulatory. For this reason these English procedures may offer ideas to us.

FEDERAL GOVERNMENT SHOULD EXPAND ITS EDUCATIONAL ASSISTANCE ACTIVITIES

Our Federal Government is limited in the areas which it may regulate by law, but under the welfare clause of the Constitution it is not limited in the areas where it may offer aid and direction which individuals, organizations, and States are free to accept or reject. It is my belief that the Federal Government should expand its educational activities, confining them to assistance and service, but eschewing regulation.

SYSTEM OF PARLIAMENTARY GRANTS-IN-AID

A striking fact about the English system of public education is that it was built up by means of parliamentary grants-in-aid. Since grants may be the only means whereby the Federal Government can help raise the quality of American education, I thought you might be interested in hearing what the English have been able to accomplish through wise disbursement of money grants. I believe the crucial factor has been that almost from the start Parliament delegated responsibility for disbursement of these grants to a permanent agency.

The first parliamentary grant, made in 1833 for £20,000, or about $100,000, was allotted to the two voluntary church bodies who were conducting charity schools for poor children. Established in 1808 and 1809, respectively, these were the non-Anglican, Nonconformist British and Foreign School Society and the Anglican National Society for Promoting the Education of the Poor. The grant was to aid these voluntary church societies to build and maintain schools. Thirty-seven more years were to elapse before the intense rivalry of these religious bodies abated sufficiently to permit them to be merged into a state school system. In 1833 there was as yet no possibility of getting them to cooperate in anything.

Just as a matter of historical curiosity, I would like to mention that this original grant was for the same sum that had been appropriated two centuries earlier by the Puritan Parliament, then engaged in trying to provide England with a national system of education. This early effort never bore fruit; but the 1833 act started England on the road to public education. In 1839 the annual parliamentary grant was raised to £39,000. A very important step was taken simultaneously.

ROLE OF PRIVY COUNCIL ON EDUCATION

Responsibility for disbursing parliamentary education grants was vested in a permanent education agency, the Committee of the Privy Council on Education. I believe it is only because Parliament set up this permanent grants committee that the English were able to build up a system of education by means of money grants alone. Originally, the committee had no other mandate but to make the best possible allotment of the funds at its disposal. Over the years its activities expanded and ultimately it became a Ministry of Education

Of great importance for the future of English education was the appointment to the chairmanship of this committee of a man who for years had been active in promoting better schooling—Kay-Shuttleworth, a physician, not an educator; a man whose concern with the poor education of England's children sprang from practical experience, from public health work in industrial English towns. His appointment set a precedent, so to speak, for choosing for this position men who were personally committed to better education. England has been fortunate in having had educational leadership of uniformly high caliber. The entire system of education has benefited by having had at its head intelligent, well-educated persons with a deep concern for excellence in education. This has been missing in our country.

ESTABLISHMENT OF NATIONAL STANDARDS AND PROFESSIONAL TEACHER TRAINING

Kay-Shuttleworth showed wisdom and good common sense in laying down principles for his committee. Most of them have stood the test of time. Of great importance was the rule he set from the very start that grants would be awarded only on condition that the recipients accept certain standards and that they grant the Government a permanent right of inspection to make certain these standards were being properly carried out. He considered it only fair and proper that a school accepting financial aid paid for by taxes levied on all the people of England should conform to national standards designed by the committee for the purpose of raising the educational level of the whole country.

His first step was to draft model trust deeds which the church bodies had to accept in return for money to build new schools. The trust deeds made certain that the schools were safely constructed and that they would permanently remain dedicated to educational purposes. His next step was to try to get the two church bodies to accept grants for establishing a national normal school or training college for teachers. Here he met a setback. The rival church bodies would not cooperate to support a teacher training institute. But, as happened often during England's long, drawn-out effort to move forward in education, the committee, by doggedly keeping at the same objective, in the end succeeded. The voluntary school bodies were brought around to accept the then novel idea that teachers ought to receive professional training, and so England got her teacher training institutes. These schools were built with grant money and their students were helped with scholarships, the so-called Queen's scholarships. Through the efforts of the committee, standards for teacher education were thus from the first set nationally and have remained so to this day. Qualifications have been continually raised, chiefly on the initiative of the central education authority and with cooperation of the teachers themselves.

The educational requirements for teachers in primary schools, as well as in all three types of secondary schools, are such that English teachers now are with few exceptions well educated, intelligent persons Their professional education qualifies them to teach competently at the level for which they have prepared themselves. It would be unthinkable for an English Secondary Modern School teacher to teach a subject he had not studied thoroughly both in Grammar School and in the 3-year Teacher Training College. Unfortunately, the same cannot be said of all American high school teachers.

TEACHER STATUS AND CERTIFICATION METHOD

Because of their educational and professional attainments and the manner in which they perform their duties, teachers have a higher standing in the community than in this country. An English teacher's relation to the head of his school is that of one professional person to another, not of employee to employer. Because all teachers have taken a full grammar course, there is no great cleavage between Teacher Training College graduates and university educated teachers.

There is no state certification as with us. Grammar school teachers who possess a university degree are on the same footing as other members of the professions; their degree qualifies them. Training college teachers also obtain a university diploma; it is called a teacher certificate and is awarded upon successful performance in a comprehensive examination by the university with which the training college is associated. In England examinations are always conducted and academic degrees awarded by the university, not by the colleges composing the university or associated with it. A certificated teacher will at the end of a required probationary year be "recognized" by the Ministry of Education. For all teachers there is a good deal of in-service training, courses being provided by the Ministry of Education, by universities, and by Local Education Authorities. These are at a high level and not to be compared to the useless education courses we force upon our teachers as a condition of professional advancement.

The Committee of the Council and its successors have consistently pursued the twin goal of improving the buildings and grounds of schools as well as what goes on inside the schools. As to the relative importance of these two objectives, the English have never been in doubt. With the first grant awarded for teacher training in 1843, the education of English teachers was set on the right road, and this long before a state system of education had been created.

It is a far cry from today's teacher to the pupil-teachers, called monitors, who used to be the backbone of the church charity schools. As soon as a child had learned the elements of reading, writing, and arithmetic, he was put to work teaching younger pupils. In this manner as many as a thousand children could be taught by a single teacher. Sitting on an elevated dais, he would deploy his little monitors throughout the huge barnlike room. This was, of course, mechanical rote learning of the worst kind, but it was cheap and it produced a modest literacy and numeracy. Through government grants and government support of teacher education, this deplorable way of teaching poor children gradually came to a end.

TEACHER LEADERSHIP UNDER THE ENGLISH SYSTEM

English education pivots on the teacher. Teaching is a lifetime career in most cases, rather than something to fill in the time before marriage—a considerable percentage of English teachers are men. Teachers are granted much freedom in arranging their programs. They consult as equals with the head of their school who invariably is a teacher himself. The English appear to believe that their teachers enjoy unusual freedom, but the same is true also in most continental countries. There, too, the educational system is managed by teachers, not by administrators.

Because the teachers know their subjects so well, textbooks are not used as much as here. The awarding of contracts for textbooks, which introduces a commercial consideration into our school system, is therefore absent. I have long suspected that one reason we can't get rid of the silly "look-say" method of teaching English is that so many vested interests are tied up in the "look-say" textbooks!

One of our perennial problems is that career advancement for good teachers lies only in school administration where their teaching talent is lost. In England this problem does not exist. The teaching profession offers career openings because all top positions are held by teachers who often as not continue to teach some courses. They can do so because schools are small and because there is much less paperwork. What administrative chores there are, will be done by a subordinate clerical staff.

Abroad, schools are viewed as intellectual enterprises. The English—like other Europeans—have trouble understanding our reverence for people who do the simple chores of buying school supplies and maintaining buildings or, worse still, for athletic coaches who often end up as principals of American schools. It would never enter their heads to put such people into positions where they can boss the school faculty. They know that for every good teacher you can lay your hands on, you could easily get a hundred men to manage a school's housekeeping business. And a teacher, to their mind, is certainly capable of supervising subordinate administrative personnel.

The English attitude toward teachers is best summed up in an official statement by Sir Geoffrey Crowther:

> We need our children to be brought up by men and women who are good people, good teachers and good at the things they teach. It is as simple as that, and as difficult. Those of us who have had the good fortune to be taught by such people know that it is worth any sacrifice to secure it for our children.

CRITICISM OF OUR TEACHER CERTIFICATION SYSTEM

A country can give its children no greater gift than good teachers. In most of our States this is made impossible by teacher certification requirements. One disgusted parent, Albert Lynd, has said that professors of education; that is, professors who give courses in education, "have copper riveted one of the neatest bureaucratic machines ever created by any professional group in any country anywhere since the priesthood of ancient Egypt." Mr. Lynd points out that no one may go to work in a public school unless he has obtained a certificate. And, in all too many States, the certificate is concerned chiefly with the would-be teacher's having taken the courses of these professors of education. It is unlikely that anyone would attend them, for they are of little use and extremely boring. But our teachers throughout their career must furnish the professors with a captive fee-paying audience. Unless they keep on going back for more credits, teachers often will receive no promotion and no salary increase. Thus has mediocrity been fastened on the American teacher.

THE NECESSITY OF RAISING OUR TEACHER EDUCATION STANDARDS

Somehow we must rescue our teachers from the professors who give these courses; somehow we must manage to raise their educational standards. This essentially was the problem that confronted the Committee of the Council in the 1830's and 1840's. The English example shows it can be solved and that judicious use of money grants can help set standards. We, however, are constantly told this would go counter to our Federal form of government.

In this connection it is interesting to note that the possibility of utilizing Federal power to sponsor higher learning was discussed by the Founding Fathers. Some delegates proposed at the Constitutional Convention in 1787 that a definite clause be included in the Constitution, enabling Congress to establish a national university. The clause was in the end left out because the Convention believed that since the Federal Government controlled the capital district it already possessed all the powers necessary to take such action.

The men who shaped our Constitution clearly felt that Federal aid to higher learning was compatible with our form of government. All six of our first Presidents believed a national university would be a desirable project and George Washington even left a special bequest to Congress in his last will which was to be used exclusively for this purpose. It was never so used, and no one seems to know what happened to the money.

I cannot think of a better purpose to which we could put public money than to establish and support better teacher education facilities. This could be done by setting a national standard and granting national accreditation to teachers colleges or education departments whose diplomas met these standards. Alternatively, teachers could be personally accredited if their educational achievements met the standard; somewhat in the manner in which the English Ministry of Education "recognizes" teachers who have received a university teaching certificate and who have completed a probationary year. Much could be accomplished, even though the national standard must, of course, be purely permissive. I should judge that it would be possible to encourage compliance with the standard by combining it with Federal grants. These could be in the form of grants to teacher-training institutions, scholarships for teachers preparing themselves to meet the standard, or grants to schools that would allow them to add a premium to the salary of nationally accredited teachers.

UNIFORM ACADEMIC STANDARDS IN ENGLAND

Despite decentralization, English education is surprisingly uniform in academic standards. This is assured not only by the professional qualification of teachers but also by the English School Inspectorate. The Dutch appear to have invented the idea of school inspectors and the practice is quite common on the Continent. The English Inspectorate, however, has proved itself to be a particularly effective means for tying together England's decentralized school system in which every school is a sort of island governing itself. For this reason I would like to describe it.

GRANTS-IN-AID ACCOMPANIED BY NATIONAL STANDARDS

Kay-Shuttleworth, the first chairman of the Committee in Council laid down the principles that to this day govern the work of the Inspectorate. He wanted to achieve two objectives: *First*, he wanted to make certain that public money was being spent for the purposes and under the conditions for which it had been granted. This was in accord with the rule he made that recipients of the people's money must accept national standards set by the Committee of the Council. Inspection was to make certain the standards were being maintained.

INSPECTION SYSTEM FOR MAINTENANCE OF STANDARDS

Second, he wanted to make use of the inspection machinery to aid constructively in improving the schools, so that public money spent on them would produce the best possible results. In course of time, this second purpose of inspection has grown to be the more important.

Kay-Shuttleworth wanted the inspectors to carry out their tasks "by a process of persuasion and suggestion based on experience," not by issuing orders to schools or to teachers. And this they have successfully done for over a hundred years. England has inspectors for every type of education below university rank. In technical fields, inspectors often are people with much practical experience. Not having our certification rules with their requirement of "education" course, England makes full use of professional men to teach in institutions of "further education."

Inspectors are carefully chosen and are subject to a 2-year probationary period. Most inspectors are in their middle years and have had successful teaching careers; all are highly qualified in their special fields. Their most noticeable attribute is tact. Since they do not and are not expected to promulgate any particular form of curriculum or any particular methods, tact is essential if their suggestions are to be persuasive.

Inspectors are assigned a certain number of schools in a given area which they visit singly or in teams of two or three. They remain several days at each school, sitting in on classes, discussing problems with the head and the teachers, hearing about the educational goals the school has set itself and how it tries to achieve them. By virtue of their personal experience as teachers, and the knowledge of worthwhile teaching practices and procedures they have gathered on their rounds, inspectors always have useful suggestions to make; being colleagues of the teachers whose work they observe, their advice is welcome.

THE INSPECTORS TRIPLE FUNCTION

The inspectors are not emissaries carrying orders from the Ministry of Education; such orders are hardly ever given in England. Technically, they are in fact Her Majesty's, not the Minister of Education's inspectors. They have three specific functions:

First, they are the Minister's "eyes and ears." After each visit a confidential report on the school is written and sent to London. By means of these reports the Minister keeps himself informed on the state of education throughout the country. He will know where there are weak spots that might perhaps need additional grants-in-aid; he will know where a school does particularly good work that should perhaps be brought to the attention of other schools. The Ministry advises the local school officials of the results of the inspection. This is done privately and there is no publicity which might embarrass the school.

Second, the inspectors are "missionaries of good education." Since they are continually visiting schools and watching teachers at work, they naturally learn a great deal more about the art of teaching than their own experience as teachers could have taught them—a great deal more than any one teacher can know. Inspectors are "experts" in education whose travels enable them to carry good ideas and good practices from school to school. Like so many Johnny Appleseeds, they go about the land scattering seed from which better schools grow.

Third, the inspectors are the Ministry's "watchdogs"; they observe whether grant money has been properly spent in accordance with national standards and requirements. When I asked them, the Ministry people could think of but a single case where a school had to be warned that, if it continued to violate the provisions of the 1944 Education Act, grants might be withdrawn. This was a case of religious intolerance. One warning sufficed. Compared to the contributions the inspectors, as a body of "experts," make to educational improvements the "watchdog" function is insignificant. Yet it probably does prevent serious slippage in standards.

What makes the inspectorate so successful is the quality of the men who compose it; by profession they are teachers, not administrators or bureaucrats. They bring what might be called the national viewpoint on education to schools which otherwise might become too narrowly local in their aims and attitudes. The inspectors are influential, even though they wield no power; rather as English policemen armed with only a stick often carry more influence than heavily armed gendarmes in other countries.

"BUREAUCRATIC MISMANAGEMENT OF ACCREDITATION" IN THE UNITED STATES: NEED FOR IMPROVEMENT

Despite superficial similarities, the English inspectorate must not be thought to resemble our own school accrediting agencies. The latter appear to concentrate on buildings, equipment, and matters such as whether every teacher has the right number of education credits. An English school doing excellent academic work would never be punished for not giving a course in domestic science or shop—as happened in Holland, Mich., where such a school was threatened with disaccreditation for college admission unless it instituted such courses. This surely was a prime example of a bureaucracy losing sight of the very function for which it had originally been set up: what has shop or cookery to do with the college preparatory qualifications of a high school? It would also be utterly inconceivable in England for an inspector to try to unseat a first-rate head of a first-rate school because he lacked a few courses in "education administration." This happened to New Trier, Ill., Central High's principal, William Cornog, who actually had to go back to the University of Chicago to take education courses, on pain of having to resign or of seeing his school disaccredited. The villain in both cases was the North Central Association of Schools and Colleges. What makes this case a sort of prize educationist boner is that Cornog had been offered the position of professor of education at the very university where he later meekly went to take courses in "education!" Meanwhile, all sorts of schools with nonscholarly ex-coaches never have any trouble with accreditation!

Bureaucratic mismanagement of accreditation, as shown in these two case stories, is but another proof that nonteaching administrators cannot properly run an intellectual enterprise. Only a bureaucrat would fasten on trivia to threaten a school with disaccreditation; a teacher would know what makes a school a good institution. But here again improvement can only come if we raise our teachers to the status of genuine professionals and put them in charge of our schools.

A good inspection system instead of the kind of accreditation we presently have would allow us to keep the management of our school system decentralized while establishing and maintaining uniform scholastic standards. This is what we do in the Navy. We have, as it were, a decentralized supply of machinery for nuclear reactors but with a uniform national standard of quality. We set the contractors a standard, that is, a set of specifications they undertake to follow for the products we buy from them. Through inspectors we make certain they conform to this standard. In this manner we get products that are of uniformly high quality.

NATIONAL EDUCATIONAL QUALITY AND THE NATIONAL EXAMINATIONS

A third device insuring national quality standards in English education is the external national examination leading to national certificates and diplomas. Of the General Certificate of Education or GCE examinations I have already spoken in some detail. Additionally, there are national examinations leading to technical or professional diplomas such as the National Certificates and Diplomas at "ordinary" and "higher" level and the Diploma in Technology. Without exception, these are examinations going deeply into the examinee's knowledge, as well as his ability to apply this knowledge to unforeseen circumstances—in this case the specific problems he has been given in the exam. England gives the most careful consideration to making the exams a fair test of a person's real capacities; the examinations are judged by persons trained to this exacting task, with many safeguards against error; they are not machine-tested examinations.

In modern life it is often important to discover what the educational achievements of a particular person may be. Education is not as mysterious as our sociologically and psychologically inclined educationists would have us believe. The French with their usual clear logic define schooling as transmission to growing children of the kind of knowledge they will need in life, and development in them of skill in using their brains. Admissions officers of higher education institutions and employers must know what a man has learned in order to judge whether to admit or to employ him.

There are only two feasible methods for awarding diplomas that give this information *accurately*. One is a centralized education system in which every school has a precise assignment to complete before it can graduate its pupils; this, roughly speaking, is the French system. It would not suit us. It must be admitted, however, that it is highly effective scholastically. The other is the English way. Education is decentralized. Teachers and heads of schools are given widest discretion in planning their schoolwork. To tie together all this organizationally decentralized schooling and assure that it meets its intended purpose you need an inspectorate or national examinations, preferably both. We have neither, and we are proud of our anarchy.

THE NATION'S NEED FOR A NATIONAL SCHOLASTIC STANDARD

A national examination would give the general public a yardstick to measure local school performance. It would have to be an entirely voluntary examination, as indeed are all the English national examinations. But they are such good indicators of a student's capabilities that they have attained widest acceptance on their own merit. The mere existence of an examination conforming to a scholastic standard set by a respected national agency would be protection against incompetent schoolmen and against unconscionable experimentation with pedagogic novelties. Take "look-say," which has created a large group of American youth who do not read or write with ease even though, properly taught, they could do so. Had there existed a highly respected national examination with English compositions and essays, the absurdity of the "look-say" method would long ago have been glaringly evident to the general public, and the American people would have put pressure on the schoolmen to drop it.

Incompetence cannot easily be hidden when the public has a standard. We have Federal standards prohibiting merchants from using harmful ingredients in the merchandise they sell. We have Federal standards requiring them to label the contents of merchandise honestly. But in education we have no Federal standards. Our school system is not only the most decentralized in the civilized world but the most standardless. Laymen cannot inspect every school and college to check whether its name or the name of the diplomas it awards accurately reflect scholastic levels that are commonly associated with these terms. Nor can the public judge whether our schools are keeping us educationally competitive with countries with whom we may be competing economically or politically or both. With a national scholastic standard, however, academic labels would in time come to mean exactly what they say.

The English Certificate of Education examinations are more flexible than comparable examinations on the Continent. They are widely used in the British Commonwealth, children sitting for the GCE in schoolhouses in all sorts of out-of-the-way places. Their papers are sent to the English examining body for marking. Then, too, each year roughly 20,000 students from overseas take the examinations in London alone. One of the great advantages of the GCE exam is that it can be taken in small or large doses. The brightest English Secondary Modern School students are now taking up to three subjects at "O" level; the brightest Grammar School students may take eight or more "O" level, two or three "A" level, and a couple of "S" level exams. Since a student himself decides how many subjects he will attempt, the examination readily responds to rising scholastic standards. We could as a first step try to set up national examinations for college preparatory high school diplomas patterned on the English GCE "ordinary" level exam, taken there by 15- and 16-year-olds. Later we could raise this standard. Naturally, I do not mean we should use the actual GCE tests; I mean that we could make use of English experience with the GCE in designing similar American tests.

It may be said that we already have the college board achievement tests. I think we should utilize these for all subjects that lend themselves to multiple choice questions that can be evaluated accurately by IBM machines. Most math and science tests would come under this rubric. But in the humanities, individual written papers evaluated by competent examiners are a far surer means to test a person's real knowledge and ability. Machines cannot measure the quality of the answer evolved by a subtle mind operating on complex problems. Such problems will be answered more satisfactorily by an essay since they are not the kind that respond to a simple "Yes" or "No."

What I suggest is nothing radically new; merely an improvement on existing private examinations and their extension to children who will not enter college. In England such children are now being given a chance to enter a national examination at Secondary Modern School level and to obtain a national diploma that will prove useful to them in post-secondary school vocational training courses and for entry into certain types of jobs.

EVOLUTION OF THE ENGLISH NATIONAL EXAMINATION

The English examinations grew out of already existing private examinations; this is another similarity that might make it easier for us to accept the English pattern. The first step toward creating a school leaving examination was taken in 1847 by the headmasters of the major private schools—the "public" schools. They collaborated in setting up a College of Preceptors which among other duties, was to produce examination papers for students leaving the "public" schools and intending to enter a university. The purpose of the exam was to facilitate admission to the university by giving an accurate picture of the examinee's scholastic attainments. The first examination took place in 1853. The schools were soon able to interest the universities in taking over the examining job. In 1857 Oxford, in 1858 Cambridge agreed to set up Local Examination Delegations to conduct the test. Unlike similar examinations on the Continent which are usually held in the student's school, England has always shown preference for external examinations. Indeed it may well be that these are the only effective tests feasible in a decentralized school system.

These university-administered English examinations played the same part in establishing and maintaining scholastic standards that on the Continent was taken by Ministries of Education. Of course, England at that time had neither a ministry of education nor even the rudiments of a state school system. Absence of centralized direction eventually created as great a chaos in English university admissions as we have here today. As new universities were founded, they set up their own examining bodies and these had different ideas about what should be examined and at what scholastic level. What was urgently needed was an examination of national standard and value. English students sometimes tried out for as many as six entrance examinations before getting into a university. In 1918 the Board of Education took a hand. It instigated a cooperative endeavor, with the schools, the teachers, and the university examining bodies all participating, which produced England's first national examination, the so-called School Certificate, tested at age 15–16, and the Higher School Certificate, tested at 18. These remained in force from 1918 until 1951. They were examinations taken by the whole graduating class and had to be passed for a wide range of fixed subjects, exactly as is the case with continental examinations. The advantage of this type of exam is that it makes certain that all who pass have had a broad liberal education. This was satisfactory so long as England had only one type of secondary school—the Grammar School.

Under the 1944 Act with its three secondary tracks, such an examination was no longer suitable. With ministry guidance, the GCE was therefore created. By allowing every student to choose his subjects and to decide how many "passes" he will attempt to obtain, the GCE can be taken by students in all secondary schools. This particular feature would make the GCE attractive to a school system such as ours. Many students could get a GCE but the number of "passes" as well as the relative difficulty of the subjects tested would vary. Yet each GCE, being clearly marked as "Ordinary," "Advanced," or" Scholarship" and listing the subjects taken, would show what the examinee had learned at school.

Here is how the British go about making sure that the quarter million students tested for GCE each year are given a fair chance, while having their capacities fully laid bare:

To start with there is a Secondary School Examination Council that supervises the whole procedure. In 1918 it consisted of 18 members, half approved by the university examining bodies, the rest by the Local Education Authorities and by the Grammer School teachers. The council has since been enlarged to 31 and its composition has been changed. Of its members, 5 are nominated by the Minister of Education, 8 by the Local Education Authorities, 11 by the teachers, 6 by the universities who maintain the 8 existing university examining bodies, and 1 by the Central Welsh Board which maintains a ninth examining body. The most interesting aspect of the change in the council's membership is the steadily growing influence of England's secondary school teachers. On the 1918 council they were represented by one quarter of the members, on today's by over one-third. In fact their representatives are the single largest bloc on the council; as large as that of the Ministry of Education and the universities *combined.* This is indicative of the important role English teachers play in setting scholastic standards.

The GCE, of course, sets such a standard. It is the ultimate test of what the grammar schools have accomplished, of what their students have learned; it allows everyone to judge these achievements. When it is remembered that the English inspectorate, the other great device for maintaining standards, is recruited entirely from teachers, it can be seen how completely English education is in professional hands. This, of course, is why it is so good.

CONSTRUCTION AND CORRECTION OF EXAMINATIONS

The examinations are conducted by nine university examining bodies, each providing its own examination papers. Much forethought and careful planning goes into the "setting" of the GCE examinations. Every examination paper in every subject is the end product of a long and laborious process involving endless discussions in committees of teachers and examiners. It takes about 9 months to draw up the examinations, during which time they are being sent back and forth from teachers in Grammar Schools to the examining bodies. The purpose is to make the exam truly reflect the desired scholastic standard yet be free of any tricks or traps. Examinations at ordinary level usually take 2 to 3 hours per subject; at advanced levels there will be two to three sessions, each about 2½ to 3 hours long. Each paper is evaluated by an assistant examiner who is normally a teacher and who has undergone considerable training and briefing by the head examiner. Great care is taken to make sure that no person's idiosyncracies creep into the marking of the essays. A few sample marked papers are submitted and checked by the head examiner before the assistant examiner gets really down to business.

When the papers have been corrected, they go to the university which has set up the particular examining body; here clerks check for mechanical errors. Meanwhile the examiners themselves have been tested as to whether they have marked "to a common standard"; if not, allowance will be made in the final marking. The percentage of "passes" from any given school is checked back against last year's percentage; if there is a discrepancy, the whole batch is gone over again. Finally, the papers are sent to the student's teacher who will check whether they come up to reasonable expectations; if not, they are reexamined. So-called "borderline" papers are gone over by the chief examiner who must make the definitive decision whether to grant a "pass" or not.

The procedure is essentially the same for all three GCE level exams, except that at the higher levels each examinee will usually present three or four papers per subject and evaluation is more difficult, so there is more work for the chief examiner. Most of those who take advanced and scholarship exams apply for scholarships. The examining bodies have the responsibility of recommending for or against award of such scholarships.

Infinite care goes into the whole GCE process. The several university bodies make every effort to set and evaluate tests to a common standard though one hears it said that one university may be somewhat tougher than another. It seems to me that England's GCE procedure really brings out a candidate's true level of scholastic achievement. The procedure may sound difficult and expensive but consider how much time individual colleges and universities would save in this country if we had something comparable to the GCE.

ENGLAND'S NATIONAL TECHNICAL EDUCATION EXAMINATION

Essentially the same procedure is used for England's various national technical examinations. These come after the end of secondary schooling and are graded to different levels of specialized training, ranging from that of the future skilled craftsman to that of the full engineer. There is even a possibility of preparing for GCE examination in technical colleges, and of eventually entering a university and becoming a scientist. But this is rare. What is important is that there exist these different examination levels which may lead a youth to higher professional goals.

In technical education, the government cooperates extensively with industry, especially to obtain released time for schooling. Most future craftsmen combine apprenticeship with 1 day or several evenings a week at a technical college. They may study for the examinations leading to the City and Guilds of London Institute Certificate which, though not national, is taken by so many future craftsmen that it partakes of the nature of a nationwide diploma. Or they may study for a national technical degree called the National Certificate "ordinary" level. On this foundation they may build through "further education" and eventually obtain a National Certificate "advanced" level. This would all be in a combined work and study program. Alternatively, students may go from secondary school into full-time specialized studies at a technical college, obtaining the National Diploma "ordinary" or "advanced" level. The diplomas represent roughly the same degree of training in the major technical subjects covered but, being acquired in a full-time study course, give the student broader training in ancillary subjects.

AMERICAN EQUIVALENTS TO ENGLISH TECHNICAL DEGREES

An estimate of American equivalents of these degrees which are taken by large numbers of young Englishmen can be found in George Louis Payne's excellent book, *Britain's Scientific and Technological Manpower*, published in 1960. The "ordinary" certificate or diploma rates about 1 year of an American engineering school; the "higher" certificate or diploma rates at least 3, in some cases 4 years of a U.S. engineering college course. The newly established Diploma in Technology is, as I mentioned before, approximately at the level of an American science or engineering doctorate. If technical degree aspirants are added to English university students, the percentage comes close to that of students enrolled in continental universities and university-rank technical institutes. The Continent has until recently been well ahead of England in developing this technical ladder to higher professional status, but England is fast catching up.

JUVENILE DELINQUENCY AND NONACADEMIC EDUCATION

Europeans are inclined to believe they have fewer juvenile delinquents than we because in their well-planned programs youngsters may enjoy the sense of importance a pay envelope gives them—even if it is small for an apprentice—while they are offered strong inducements to take further school education. The school suddenly makes a lot more sense to nonacademic young people because they can now see that more education will greatly improve their job opportunities. In all European countries, governments take an active part in promoting this type of education; there is close cooperation with industry, and everywhere there are national examinations and degrees—an inestimable advantage for workers when they move about the country.

I should mention here that the GCE itself at "ordinary" level includes craft subjects. To give you an idea of the rigor of a craft examination, let me tell you that a GCE "ordinary" pass in the craftwork-metalwork category involves the following: a written paper of one and a quarter hours, a design for which 2 hours are permitted, two so-called "practicals" requiring 2 and 3 hours, respectively. The student's capacity to do craftwork is thus tested in an examination that takes 8¼ hours. As a rule, however, an "O" level test takes 2 to 3 hours. Our College Board Achievement Tests give but 1 hour to each subject.

Mr. Payne gives an example of a zoology GCE examination at "advanced" level which shows what is expected of 18-year-olds who will probably specialize in zoology or a related science. Here is his description of an actual test:

> It consisted of three 3-hour sections. The first and second of these, administered at the school, were written papers covering invertebrates and vertebrates respectively * * *. This question is from the vertebrate paper: "Make a large, labeled drawing of transverse sections through (*a*) the region of the stomach of a whole female dogfish, and (*b*) the intestinal region of a whole amphioxus. Comment on the differences shown by these two sections." The following one is from the invertebrate section: "The crayfish is a triploblastic, metamerically segmented coelomate animal. Explain fully what is meant by this statement." The third part, given at a university examination center, was of a practical type requiring the microscopic identification of tissues, the preparation of a permanent mount slide, and the dissection of the circulatory system of the dogfish shark.

THE LONDON UNIVERSITY EXTERNAL EXAMINATION AND DEGREE

England has developed another type of examination that serves in a different way as a national standard. That is the London University external examination and degree. I know of no other university awarding this type of degree. I think I have mentioned that in England it is always the university that conducts examinations and awards degrees for students in the colleges that constitute the university or that are affiliated with it—as teacher training colleges, for instance, are affiliated with universities where teacher candidates take their certificate examinations. But the University of London is unique in that it will examine and award degrees to *anyone*. You need not have studied at a college of London University or other affiliated institute to enter for and obtain a London external degree. Many oversea ex-colonials, as well as citizens of Commonwealth countries enter for and obtain a London external degree. So do students from newly established English provincial university colleges. Such colleges do not at once obtain a parliamentary charter allowing them to award their own degrees. They must first, so to speak, prove themselves qualified to rate as a university. Their students go to London and enter for external London university examinations. If over the years the students do well and their particular college thus achieves a high reputation, it will eventually be given a charter and itself become a degree-granting university.

POSSIBLE ADAPTATION IN THE UNITED STATES

As I have said, the Constitutional Convention of 1787, as well as George Washington and five of the Presidents succeeding him, all advocated that the Federal Government establish a national university. If such a university were created and authorized to award external degrees on the pattern of those given by the University of London, we should have a means to set up a national standard for our bachelor's and higher degrees which might well be voluntarily emulated by many private colleges, perhaps even by State colleges and universities. This is what happened in England and quite without any compulsion by government.

ENGLAND'S DIVERSITY IN EDUCATION

England's judicious use of central government money grants, her excellent inspectorate, her well qualified teachers, and her extensive system of national examinations allow her to retain a decentralized school system which nevertheless maintains uniform scholastic standards at all levels. We in this country greatly value educational diversity. We identify standards with centralized education; we fear they will produce a uniformity that is distasteful to us. Yet the two need not coincide. To show you how much diversity the English still retain in their education, let me give you a brief description of the many types of schools that somehow are fitted into the state system of education.

AT THE PRIMARY LEVEL

At the primary level there are state schools established, managed, and financed by the LEA's with the help of special government grants; there are also two types of church affiliated schools with different degrees of independence as regards appointment of teachers and time allotted to religious instruction, depending on how much the church body contributes to maintenance and repair of the schools. They are called "aided" and "controlled" schools. Scholastically they do not differ from the state schools; the only difference comes through a stronger emphasis on their particular denomination; most of these schools are Anglican. About 16 percent of English children are enrolled in church affiliated schools.

AT THE SECONDARY LEVEL

At the secondary level, there are state grammar schools and endowed grammer schools receiving special grants from the Ministry of Education to supplement their income; they are called "maintained" and "direct grant" schools, respectively. As with church affiliated primary schools, the "direct grant" grammar schools enjoy greater internal freedom but their scholastic standards are at least the equivalent of the state or "maintained" grammar schools; usually their caliber is a little higher.

INDEPENDENT SCHOOLS

Ninety-four percent of English children attend these different types of schools that are all part of the system of free state education. Six percent go to private schools; the official term for these is "independent schools." At the primary level they are usually called "preparatory," at the secondary level, "public" schools. These schools articulate with one another but not with the state school system. The preparatory schools take children from 8 to 13 or 5 to 13; the secondary schools from 13 to 18. Most of the private schools are endowed but there are also proprietory schools; all charge very high fees. These schools receive no public subsidy, nor are they subject to control by the Ministry of Education. Since 1957, however, they have been required to submit to periodic inspection to ascertain whether they maintain standards appropriate to the kind of schooling they purport to offer. This makes compulsory a long-standing practice of most independent schools to *ask* to be inspected in order to be certified as having been "found efficient." Inspection is largely *pro forma* since these schools normally equal or exceed standards in the state system. But the existence of the right of inspection prevents diploma mills of which we still have a number.

SCHOOLS FOR "FURTHER EDUCATION"

England has a truly bewildering variety of schools that prepare skilled craftsmen, technicians, semiprofessionals and professionals. Most of these are wholly within the state education system. The LEA's are required to provide "further education" for students whose compulsory schooling has ended and who desire it. At the professional level, institutions usually are not under the LEA's though they may be under the Ministry of Education. Or, if they are affiliated with a university, they may be entirely independent.

UNIVERSITIES

The universities are independently endowed, high fee charging institutions. They are not under the Ministry but they are nevertheless in constant close touch with it in a number of activities, notably the GCE examinations and evaluation of candidates for state scholarships. Also, the universities now receive about 70 percent of their income from the Government.

Distribution of Government grants is through a permanent committee of the Exchequer, the University Grants Committee. Since some 80 percent of university students are on scholarship—many on state or on LEA scholarships—the fees charged these students by the universities also come indirectly from the Government. Moreover, the university examining bodies for the GCE are very influential in the award of state scholarships. While the Government never meddles with the internal affairs of the universities, it does bring its influence to bear on them in the matter of expanding their facilities to provide more university places. You can see that the interrelationships between private, semiprivate, and public agencies are extremely complex. This is because England was so late establishing public education, and also because she has at no time abolished any educational institution that did a good job.

OTHER TYPES OF HIGHER INSTITUTIONS

Often overlooked by Americans who comment on England's small university enrollment is the fact that many professional people receive their education in higher institutions that in England are not called universities. Most of England's engineers, her primary school and secondary modern school teachers, her lawyers, her nurses, et cetera, are educated in university rank or near university rank colleges and institutions. These usually have some relationship to the professional bodies whose future members they are training, or to the industries for whom they prepare technologists. But we think of English "higher" education as being confined to the universities. We make the same mistake when we talk of "higher" education on the Continent where much professional education also takes place outside the universities. And then, of course, we customarily overlook the fact that universities abroad are graduate institutions, in no way comparable to our colleges, which are undergraduate.

Fifty years ago, English education still was the most aristocratic in Western Europe but today England is in the forefront of nations where a child's educational progress depends exclusively on his achievements. Money won't get you a college degree, as is possible in our country where affluent nonacademic students can find colleges that will hand out degrees for minimum effort and accomplishment. On the other hand, lack of money will not bar an English child from going as far as his ability and effort will take him.

DIVERSITY AND OPPORTUNITY

Because postwar difficulties have prevented England from building up higher education facilities as fast as qualified students demand them, there is severe competition for places. The English have a plan for expansion and they are getting on with it as fast as they can. We, on the other hand, have no well thought out plan for the enormous mass of children who, in a decade or so will place an intolerable strain on existing higher education facilities. Admission to scarce places is in England a matter of academic merit and of merit alone. Personality traits, athletic prowess, favorable or unfavorable geographic origin—none of these irrelevancies affect admissions procedures in England as they do here.

Nevertheless the fable of England's class education system will not die, especially among our educators. Yet last year England had only 60 persons with an income as high as $280,000; in 1960 there were 66. These 60 persons had a total income of about $28 million. In 1959, in the United States, there were 280 tax returns showing an income of more than $1 million. That same year there were 1,002 returns for more than $500,000 and 5,182 returns for more than $200,000. And while the number of the English rich decreases steadily, the number of American rich grows apace. There is now a much wider gulf between the richest and the poorest in our country than in England or anywhere in Western Europe for that matter. According to Robert J. Lampman's book, *The Share of Top Wealth-Holders in National Wealth 1922–56*, in 1953, when the Nation's tangible wealth in private hands totaled $1.1 trillion, the wealthiest 1 percent owned 24 percent of it. In 1961 Mr. Lampman noted the share of the top 1 percent had increased to 28 percent of the Nation's wealth. This includes corporate stock, State and local government bonds, Federal Government bonds, and real estate. We have about 100,000 millionaires.

Of course it is true that the English "public" schools still exist and indeed have never been in a more flourishing condition. It is difficult for an American to understand why English parents will go to extreme personal sacrifice to pay the high fees of private schooling. In one preparatory boy's school, only 3 out of 21 mothers owned an electric refrigerator, a convenience most English people now consider a necessity. Fathers will give up smoking and families will forego vacations; mothers sometimes go to work to earn the tuition fees. In this country we prefer to lavish material advantages on our children—I saw in the paper that in Oregon the average high school boy now has almost $250 in spending money per year. English parents would put that money into private schooling. I should not like to judge whether it is better to give children cars, telephones, candy, and records or private schooling.

Academically, the independent schools have a high reputation that is well deserved. But the free academic secondary schools—the state grammar schools—have for quite some time been creeping up on the private schools. It speaks well for the quality of England's *free* state education that, as between graduates from independent schools and from schools in the state system the former now have but a 10-percent edge in the competition for university places. Compare this with the much greater advantage graduates of our own private preparatory schools have in the competition for places in Ivy League colleges. In the United States the 2 percent of children attending these preparatory schools get almost half the freshmen places in the Ivy League colleges. Thus they do 20 to 25 times better in the tough competition for these places than do graduates of our public school system.

The excellent performance of English students from the grammar schools is sometimes overlooked because of the impressive number of English children from the private school sector who enter the university. The major reason is that more private schoolchildren stay on in school while regrettably many students in the free state system drop out early. Early dropouts occur more often among children who are first generation grammar pupils than among children coming from homes where staying on through the sixth form, taking the GCE advanced examination and studying for a university degree are in the family tradition. They stay on through the long, tough course because they are more strongly motivated. The English have made studies showing conclusively that financial reasons do not account for early dropouts of children from uneducated homes; after all, school is free and if additional help is needed the LEA's usually provide it. The English pin their hopes on the second generation of grammar pupils. There is no way a free democratic society can effectively equalize family influence.

The private schools have no clearly definable virtue that would explain their greater holding power; the same types of students go to state schools on the Continent, and there, too, they remain at school longer than equally intelligent children from nonacademic homes. The only remaining advantage the private schools still have in the matter of university admission for their graduates is that, because of old and close relations with Oxford and Cambridge, their students have a better chance to get into these particular universities. Rather as children of alumni—all other factors being equal—have a small edge over others in getting admitted to Ivy League colleges. This advantage, I venture to say, will not continue indefinitely. Scholastically there is not in England anything like the enormous difference that exists in our country between a relatively few high standard colleges and a vast mass of institutions with low standards or no standards at all. I doubt very much that the education one can get at a "red brick" or provincial English university is scholastically very much inferior to that of Oxford and Cambridge. I am told that actually more honors degrees are being taken in the former and more pass degrees in the latter, though on this point I have no accurate data.

Nevertheless, English left wingers periodically raise the cry, "abolish the independent schools," and so make all education public. Nothing of the kind has as yet been done in any democratic nation. It is not likely to be done in England either, where the emphasis is on improving the state schools, rather than on destroying the private ones. If England ever prohibits parents from buying private schooling for their children she will have compromised her traditional respect for the individual. As a welfare state she makes inroads into private liberties, but there still remains great respect for the rights of Englishmen. Many legal and customary safeguards protect him against arbitrary action by bureaucrats. There is much more reluctance than in our own country, for instance, to condemn property under eminent domain in order to build highways. The Education Act does not compel parents to send their children to a State school or to an approved private school; it merely requires them to "secure their children a proper education between the ages of 5 and 15."

In our own country eminently qualified parents have on occasion been haled into court by school authorities, not because they did not provide their children with an excellent education at home but because the schoolmen asserted it was more important for children to be with their peer group—no matter how inferior the local school might be scholastically. Our courts have sometimes had to remind overeager bureaucrats that parents still have a few rights. So in a censorship case Superior Judge Luther Alverson of Georgia remarked:

> The defendant's concern with the welfare of our city and its children is highly commendable. It is obvious, however, that parents are more competent to rear children than the State.

ENGLISH EDUCATION SYSTEM: FLEXIBLE AND ADAPTABLE

Like their constitution, the English education system is highly flexible, highly adaptable to changing needs. It makes room for a great variety of public-private interrelationships. It is set up to bring intelligence and professional competence to bear on management of the schools, on planning for the nation's future educational requirements, and on assessment of individual achievements through national examinations. English education is sufficiently decentralized to create adequate opportunities for trying out promising new ideas and practices. Yet it provides safeguards against the endless experimentation that goes on in our school system. England has developed procedures to establish and maintain good scholastic standards that could, I believe, be made to work in our country as well, since they do not go counter to out political institutions.

In observing the English school system we must keep in mind that it is still incomplete; it is still being built up but they have a *plan* and we can see it emerging. Even at its present stage of development, the English have accomplished some things that we, who have had a public school system for nearly a century, have yet to achieve. What I consider most important is that schooling is compulsory for 10 years and this is so faithfully observed that attendance is just about 100 percent. For purposes of comparison we will do well to accustom ourselves to think of English 15-year-olds as having had as much classroom instruction, at least in academic subjects, as American 18-year-olds. This takes account of the fact that they begin school a year earlier and attend class more hours per school year.

Keeping this fact in mind, consider that England today has no children who quit school with as little formal education as the 27 percent of our own children who, in the year 1958, dropped out at the end of the 10th grade or *earlier;* the 5.5 percent who dropped out at the end of the 5th grade. Bad as these figures are, they are a great improvement over the situation 10 years previously, in 1948, when 55 percent of our children dropped out with 10 years or less of schooling and 29.5 percent with but 5 years. We still manage to get no more than half our children through high school. In cold facts, this means *half our children* obtain less schooling than the compulsory minimum *all English children* are compelled to obtain.

Worse still, English children who drop out as soon as the law allows—after 10 years—attend "further education" institutions in considerable numbers. In 1958 one-quarter of the 15-year-olds as well as of the 17-year-olds—both boys and girls—were enrolled in evening school courses. Another 16 percent of 15-year-old and 24.5 percent of 17-year-old boys were attending part-time day courses; the figures for the girls were 7 and 6 percent. These figures reflect England's increasing development of combined apprenticeship, part-time schooling programs. She still lags behind the Continent where such programs have flourished for a very long time, but she is rapidly catching up. In these part-time courses, vocational or technical education is combined with some general education. Far fewer of our young people are in such programs. In fact, for our less able children we can claim no numerical advantage in schooling at all; quite the contrary. What then of the quality of the schooling provided for less able children here and in England?

For children in the middle range of ability that lies between the educationally subnormal—who are cared for in special schools—and the top 30 percent of the intelligence scale, England provides in her Secondary Modern Schools an education that concentrates on the "solids;" on English, mathematics, science, history, geography; and that devotes to this basic education as much classtime as would correspond to about 13 to 13½ of our Carnegie units; when children take a foreign language, this may rise to 16 units. That is close to top requirements for American high school diplomas.

English Secondary Modern school children are taught by teachers who today are required to complete a full grammar education, who must obtain a good advanced GCE, and study their subjects and pedagogy for 3 years in a teacher training college. These English teachers are above teachers in many of our high schools in general education as well as in professional competence.

England's financial difficulties have delayed school construction but many Secondary Modern schools are now housed in new buildings. Though these do not reach the luxury standards of some American high schools, they are suitable and attractive. Under Ministry of Education auspices standardized model school buildings of various types have been designed. These are simple, inexpensive, and serve their purpose so well that several continental countries have been willing to pay the Ministry royalties for the plans of these school buildings. It is worth noting that in spite of generally rising prices, it cost the English less for a new school place in 1958 than it did in 1949.

I think an unbiased observer must admit that England gives her nonacademic children a better basic education than we do. But her performance in serving the needs of her academic children is even more striking. Almost a third of these enter an academic secondary school. Contrast this with the 15 to 20 percent Dr. Conant estimates could "take" his relatively modest college preparatory high school program. Whereas only 5 percent of American 18-year-olds take the college board achievement test, 16 percent of the English 15- to 16-year-olds complete the 5-year grammar course and obtain passes in the full course of GCE ordinary level examinations—about five or six subjects compared to but three subjects in our college board achievement test. This 16 percent of English academic children will at age 15 to 16 have completed a better college preparatory course than most American 18-year-olds; certainly a somewhat more demanding course than the one proposed as a *goal* for American high schools by Dr. Conant.

When he undertook his study of the comprehensive high school, Dr. Conant set himself the task of discovering whether enough of our high schools satisfactorily satisfied three functions: that is, did they "provide a good general education for *all* the pupils as future citizens of a democracy, provide elective programs for the majority to develop useful skills, and educate adequately those with a talent for handling advanced academic subjects—particularly foreign languages and advanced mathematics." Conant and his associates visited 103 schools; he found 8 schools satisfying his conception of what an adequate high school should be.

Using these eight as models, Dr. Conant drew up a college preparatory high school course which he felt 15 to 20 percent of our youth were able to follow through. It consists of 4-year courses each for English, mathematics, and foreign languages, and 3-year courses each for science and the social sciences. This program is a *goal* which only a small percentage of American high schools have as yet attained. The goal is, in my estimation, scholastically more modest than what is already being achieved in England by 16 percent of her children who are, moreover, 2 to 3 years younger than American high school graduates.

Finally there are England's brightest—her top 10 percent in both ability *and* motivation—who complete the sixth form of Grammar type schools and obtain a good advanced and scholarship GCE which, as I have shown, corresponds pretty closely to the average American bachelor's degree but is obtained in England at age 18.

This comparison of educational achievements in England and the United States leaves me profoundly disturbed. The generous desire of the American people to educate all children has foundered on an impoverished logic in whose eyes everything is equal; on the shallowness of professional thinking among the educators. Unfortunately they have seized on the fact that society nowadays offers more education than many children are willing to take—witness the drop-out problem—and they have concluded that school must be fun so it will attract and hold children. They have educated us *down* to their own level. The American people have recognized for some time that this concept is bankrupt.

Might it then not be wise for us to examine and profit from the English example where the objective is to give *every* child the maximum education he is capable of absorbing, no compromise being made, however, with academic standards. The figures I have just cited show that the English system gives better education at every ability level.

Mr. Chairman, I hope what I have said has given the committee some idea of English education and how it compares with ours. I will be only too glad to answer any questions you or members of the committee may ask.

Mr. CANNON. Mr. Mahon, have you any questions?

IMPROVEMENTS IN OUR SYSTEM SINCE SPUTNIK NO. 1

Mr. MAHON. Admiral Rickover, in October 1957 the Soviet Union launched the first artificial earth satellite, Sputnik No. 1. This act became the springboard for a great deal of discussion about education, especially scientific education. Some very high resolves were made in regard to educational programs. Certain action was taken and certain legislation passed.

How do you evaluate our school system as of the present, compared with October 1957? Has there been a marked increase in progress?

Admiral RICKOVER. Mr. Mahon, in my opinion there has been a good deal of spontaneous local effort, but it is not coordinated. Many boys and girls, and particularly their parents, have recognized that to get ahead in the modern world they will have to study and work harder. Improvements have been largely local, and I fear a lot of it is dying out because the mainspring of education is the teacher; without good teachers little improvement is possible. Not much has been done to improve the teacher.

My answer is: there has been a great deal of voltage but not much current. Until the Federal Government sets up a standard—a permissive standard—to enable parents to judge the products the schools turn out, it will be difficult and take a long time to improve the quality of our teachers and the quality of education.

U.S. GOVERNMENT RESEARCH GRANTS: SUGGESTIONS FOR IMPROVED PROGRAMS

Mr. MAHON. I would like to ask you to comment on an action by the House with respect to grants to colleges for various types of research on military problems and in medical research. We placed a limitation of 15 percent for overhead on grants to colleges in the Defense Appropriation Bill. The colleges reacted very much against this action. Some said that we talk about education and the need for scientific improvement and yet we tend to discourage an acceleration of scientific work in the colleges by placing in appropriation bills a 15-percent limitation for overhead.

What is your general feeling toward the policy of the Government in making grants to colleges for various research projects? Is this a good way to get the job done?

Admiral RICKOVER. This is a pretty big subject, sir, and I am not fully qualified to answer it. My feeling is that there are two defects in the way this is presently being done. In the first place, you have practically no check on what happens to the money you appropriate to various agencies and which they then use to award university research contracts. You, in the Congress, may designate what the money is to be used for, but it is the bureaucrats who actually hand it out. You have no machinery to keep yourself fully informed whether the money is being put to the use you intended, or how well the recipients do the job they take on in return for the Government money.

I would strongly recommend you set up something on the order of the English University Grants Committee, so that there would be one agency that would keep overall supervision, seeing to it that there will be a minimum of duplication and that, on the other hand, worthwhile projects are not being neglected. With all its many duties, the Congress cannot do the job of supervising itself. It can't take time out to decide how much in research grants is to go to the University of Chicago, how much to the University of Michigan, and so on. You would be tied up 24 hours a day on this one item of business. I suggest that a committee composed of trustworthy persons, to which you would give the responsibility to see that grants are used as the Congress intended them to be used, would be very helpful. The committee would report to the Congress periodically or upon request.

Now there is another and perhaps even more serious defect in the present system of handing out Government money for research. It can lead to neglect of the university's primary purpose which is to educate young people. The Government may actually do harm if it tempts our financially hard-pressed universities to take on research projects in order to be able to attract and hold outstanding professors. As you know this does happen. It is quite natural that it should happen, for as a nation we do not fully accept the necessity of giving tax support to higher education, at least not Federal tax support. In consequence Government research contracts are now being used to support *education* indirectly while they purport to be strictly for *research;* and education comes off second best.

We are eating our seed potatoes. We forget that universities are not primarily places from which one orders particular research work. They are primarily places where young people go to become educated. If this purpose is neglected, where will future university researchers come from? I feel that in some cases Government research contracts have deflected universities from their teaching responsibilities. American university professors are now dashing off in all directions, advising and consulting the Government and industry, and heading up lavish research projects. We need a better balance here. If the Government were as generous in supporting *education* in our colleges and universities, as it is in making *research* grants, there would not be this temptation for our best professors to move into Government and industrial research, to the detriment of the students and of our country.

U.S. EDUCATION'S NEEDS: GOVERNMENT SUPPORT, NATIONAL SCHOLASTIC STANDARD

It would be better, I believe, if we faced up frankly to the need for Government help to our institutions of higher learning. With universities as with our public schools, we have two big problems: one is that the sources which heretofore supported them financially no longer can cope with the enormous influx of children and young people. We are among the fastest growing peoples in the world. We must make a plan how we are to educate our rapidly increasing school and college population. If for no other reason, the Government should support education so that this country will be educationally competitive. That is the financial problem. The other problem has to do with the quality of American education. I am convinced that this cannot be adequately improved without some sort of permissive national scholastic standard. So both these education problems will need Federal action of some kind.

As to support of the universities as teaching institutions, quite irrespective of whether they do or do not carry on Government research work, I feel it must come. Abroad, in England, in the free countries of Europe, in Russia and her satellites—everywhere there is in one way or another public financing of higher education—part of it at least comes out of taxes. Nearly all continental universities are part of their particular national systems of public education and most of their expenses are paid by public money. This is why they can offer an education at nominal cost or, in some countries, entirely free.

University fees rarely exceed about $100 per year, somewhat more for medical studies. France has university-rank institutions, the so-called *Grandes Écoles*, where all of a student's expenses are paid. English universities are private, high-fee charging institutions, but 80 percent of English students are on scholarship, not a few of these being paid directly or indirectly out of general tax receipts. No university anywhere in the world can now get along on tuition fees alone. In the past, many of our private universities were so richly endowed that we did not have to tax ourselves to support them. But the sources of private endowment are drying up. So in one way or another, public money will have to flow into all our institutions of higher learning.

As for the 15 percent for overhead, I don't know whether this is adequate. Of course when a Government agency pays for a research job, the university's overhead expenses are increased and it must get the money somewhere. I suspect universities are going to need more than 15 percent.

Mr. MAHON. I am not as interested in your comments on the 15-percent limitation as I am in the overall broad policy of aid to colleges which in turn do research work.

SUGGESTED MANAGEMENT OF GRANTS TO HIGHER EDUCATION

Admiral RICKOVER. I'd like to say once more, sir, that in my judgment too much research is being done by universities and not enough teaching. One university, is this year spending about $80 million of Federal research and development funds; it now ranks among the largest Department of Defense suppliers. The Space Agency alone is getting $3.8 billion in appropriations and the Department of Defense will be getting an additional $1.5 billion for space work. So the Government will be spending in 1 year $5.3 billion on space projects alone. But the cost of operating all our colleges and universities put together is only $3.5 billion. So you get an idea what tremendous sums of money are involved in Government research grants. I believe it is urgently necessary that the Government see to it these grants will not loom so large in a university's budget that all else takes second place. Also I feel strongly that the money you appropriate for research projects will be put to better use if the Congress has the help of a special agency on the order of the English University Grants Committee to keep overall supervision and to report back to Congress how Government money has been spent.

I should perhaps say here that the English committee is concerned with education, not with Government contracts. It is concerned with the general support of English universities, not with making use of them as research contractors. It thus has a different objective than the kind of grants committee I am urging you to set up. I use the English committee merely as a pattern or model of an agency through which the spending of grant money can be done efficiently and fairly.

The committee has a very good reputation in England. The English have had much experience with permanent committees administering Government grants. As I have shown, their whole system of state education began with a small committee distributing a modest annual parliamentary grant—about $100,000.

The function of a grants committee is simply to allow the legislature to delegate the detailed awarding of money grants to a small group of eminent, well-qualified men in whose integrity it trusts and on whom it will call periodically for a report of their stewardship of the people's money. Naturally, everything depends upon the quality of the membership. In England they are all honorary members, persons in a position to do their job in a wholly disinterested manner. They are chosen from the academic staffs of universities and from among England's senior civil servants, as well as from men of eminence in general. There is a small staff but the whole thing is as far a cry from a bureaucratic organization as human ingenuity can make it. Such a committee would prove helpful to the Congress in this matter of research grants.

Since English universities are private, the University Grants Committee never addresses an order or request to them. It only suggests. The autonomy of the universities is scrupulously preserved despite the fact that the bulk of their income comes from the public exchequer. The committee "stimulates, coordinates, and advises." Because its members are intelligent and broadly educated men, they understand the country's educational needs and their advice carries weight. Not every pound is wisely spent but the committee does its job tactfully and efficiently. I think by establishing some such agency, Congress could relieve itself of the burden of keeping a constant check on how public money is spent.

THE QUESTION OF LEEWAY UNDER GOVERNMENT GRANTS

Mr. FORD. Admiral, we hear from time to time that in making these grants to colleges, universities, and to some extent nonprofit organizations——

Admiral RICKOVER. In the United States?

Mr. FORD. In the United States. The Government can't pin down the individual who is to do the grant work because it is necessary to to give him a little leeway to get results. He (the scientist) has to have some time on the outside to do as he wishes. The Government doesn't get a *quid pro quo* return for that but if you don't do this he won't do the other. Now, what is your observation on that?

Admiral RICKOVER. Mr. Ford, several years ago when I was confronted with this problem—I won't mention the name of the university—the Navy at that time was giving a substantial sum of money to a university and I talked to the man who was doing the research work and asked him if he would do some work for us in the nuclear field and he said "No." I was quite angry at the time but the more I thought about it the more I realized he was right.. I do not believe the Government, because it grants money to a university, should tell it what to do. That would be a violation of the university's traditional and essential freedom.

Mr. THOMAS. Mr. Chairman, will the gentleman yield briefly"

Mr. CANNON. Mr. Thomas of Texas.

Mr. THOMAS. I believe you have been talking with our friend in the White House, Dr. Wiesner, a little bit, haven't you?

Admiral RICKOVER. No, sir. I suppose you refer to the special assistant to the President. I haven't talked to him about this at all.

Mr. THOMAS. You have not been talking with the doctor?

Admiral RICKOVER. No, sir. I have not seen him for many years.

COORDINATION OF GOVERNMENT PROGRAMS CONCERNING RESEARCH AND EDUCATION

Mr. THOMAS. You and the doctor ought to get together because you are talking exactly the same language. The doctor has a little bill over here where he and a group are going to move in on the scientific field and take over the National Science Foundation and correlate the thing. It may be a good idea. That is what I wanted to ask you about.

Admiral RICKOVER. I don't think that is such a good idea, Mr. Thomas.

Mr. THOMAS. You don't think it would be a good idea?

Admiral RICKOVER. No, sir.

Mr. THOMAS. I thought you just said a while ago there was too much helter-skelter spending among the various agencies and there ought to be some overall coordination of it.

Admiral RICKOVER. I am not familiar with Dr. Wiesner's bill, sir.

Mr. THOMAS. I understand he is a learned and very distinguished gentleman. Sometime I suggest you meet him. He is all right. You are all thinking along the same lines. Maybe I am agreeing with you. I am not sure yet.

Admiral RICKOVER. I am not for combining the National Science Foundation, Government research, and Federal aid to higher education in a single agency.

Mr. THOMAS. My description may not be entirely accurate, but it will be an overall agency working out of the White House that is supposed to coordinate.

You are familiar with the National Science Foundation, I am sure. When they set it up it was supposed to coordinate, but I doubt if it can do much coordination. That word does not mean much unless you have some authority to knock heads together.

Getting back now to your main theory—I can't talk up any business between you and Dr. Wiesner, but I think you are talking along the same lines, and you may have a point there.

Mr. CANON. Mr. Gary of Virginia.

Admiral RICKOVER. May I amplify what I said to Mr. Thomas?

Mr. CANNON. Yes, certainly.

EDUCATION DISTINCT FROM OTHER INTERESTS

Admiral RICKOVER. I think education is important enough that it should be kept quite distinct from other interests. I would not combine it with Government defense research appropriations or with art or public health, or any other activity. It is my considered opinion that education is the most important factor in our present and future well-being. It is too important to be tied to anything else.

I suggested that you set up a committee to supervise the spending of Government research grants; this is one thing. The committee would see that Government research appropriations are spent wisely and for the purpose that you in Congress want them to be spent. I would not give this particular committee any other function; especially not the function to funnel any possible future Government grants for higher *education*—and I mean education, not research contracts—to our colleges and universities. This is another matter.

I personally feel that the Federal Government will have to give financial help to higher learning. You will remember that I told of the discussion on this subject in the Constitutional Convention of 1787. Federal support of higher learning was apparently quite acceptable to the Founding Fathers. Certainly the Congress gives financial aid to many activities—postal subsidies, shipbuilding subsidies, subsidies for building civilian nuclear powerplants, subsidies for State pollution control measures—to all sorts of activities that are not specifically mentioned in the Constitution. I personally believe Congress should give subsidies to education, specifically to higher education since this is what we are talking about. If you decide to do this, I suggest that the distribution of *education* grants—not research grants—that education grants be likewise made by a committee set up on the pattern of the English University Grants Committee, a committee having no other function than this. In other words, you might have a Research Grants Committee and an Education Grants Committee—the two being separate.

DISTRIBUTION OF GRANTS TO HIGHER EDUCATION THROUGH U.S. OFFICE OF EDUCATION INAPPROPRIATE

I regret to say this, but I would not under any circumstances assign distribution of Federal grants for education to the U.S. Office of Education, as presently constituted. It was set up anyway for collecting and distributing educational information, not as an agency that would provide leadership in education. However, before the progressives took over, the then Education Bureau often had intelligent leadership. For many decades now it has been almost completely in the hands of progressive educationists. It was the Office of Education that sponsored the whole idea of *life adjustment for all American youth*, with disastrous consequences for scholastic levels in our schools. It has long been putting out reports on foreign school systems that perpetuate the absurd notion that we have 25 percent of our youth in *higher* education compared to 5 to 6 percent in Europe—an error based on total misconception of what a European university is. It is so closely identified with progressivism in education that it uses public money to participate in the party line attack on all critics of American education.

I am thinking of a booklet put out by the Office in 1960, entitled "*Schools in Our Democracy*," in which a clumsy attempt is made to discredit the critics of low scholastic achievements in our schools on the ground that they are not interested in our children's character development. Of course, all that the critics say is that there is not enough time in our short schoolday to develop a child's intellectual potential and also take on the responsibilities normally borne by home and church.

Here is what went out over the signature of the Commissioner of Education:

> It has been asserted that intellect, not character, is what is mainly needed to build submarines. This philosophy does not fit the ideals of the American school system as conceived by our people. We don't want to cross bridges designed by an engineer without character, nor do I believe the American people would want a Klaus Fuchs working on our atomic submarines, no matter how brainy he might be. It is important that the scientist and the mathematician have broad interests, which include moral and ethical values as well as the intellectual. What good is a school with the highest academic standards if it educates geniuses who have no character and who later become criminals, traitors, and dictators?

I am not sure whom the Commissioner had in mind, but the whole line of argument is spurious. It deliberately misrepresents the plea of many sincere persons in this country that our schools return to basic education, abandon the life-adjustment trivia, and confine themselves to the technical task that only the school can do. No critic I know of disparages good character or urges concentration on science and neglect of the humanities. What the educators have been doing is to neglect both science *and* the humanities, and they have not been able at that to prevent us from having high crime rates and alarming numbers of juvenile delinquents. Incidentally, in proof that schools concentrating on their technical task do not thereby ruin their pupils' character, I cite a recent press report. Swiss Army recruits, asked what book they would choose if they were marooned on an island, voted in overwhelming majority for the Bible.

Should a Federal agency make itself the apologist for a particular theory of education? Should it put defense of this theory above the obvious need to reform our school system? Should it try to foster the impression that men of good character will not make good engineers or that brainy people who are good engineers will become traitors, criminals, and dictators? The same Commissioner got involved in the fracas over demands to remove Orwell's *1984* and Aldous Huxley's *Brave New World* from school libraries and reading lists on the grounds of their allegedly being obscene. On his own admission, the Commissioner had read neither of these two classics. He doesn't even seem to have heard about them; he was all for taking them off the shelves. As long as the Office of Education is not staffed and headed by persons of broad and liberal minds and education, it would be best not to give it any responsibilities for administering education grants.

It may be, however, that a new day is dawning. We are fortunate in our present Commissioner of Education. Mr. McMurrin is doing a fine job.

To get back to the committee I recommend you establish for distributing any education grants the Congress may decide to make. I urge that there be but a single small committee and not a huge bureaucratic organization. If you have too many people or too many agencies you invariably get too many counteracting influences and there is danger of logrolling.

INSTITUTES FOR TEACHERS

Mr. THOMAS. You are talking about your teachers and more than likely you have put your finger on the most sensitive part and perhaps, in the final analysis, the most vital part, but do you realize that you have some agencies of Government, particularly the National Science Foundation, who have set up institutes where these high school teachers go to school for 6 weeks or 3 months or 9 months and they can go on a paid basis by the taxpayers as well? As a result you have certainly made a lot of progress in the last 5 or 6 years in improving your high school teachers. About 50,000 of them a year are taking advantage of it. I think that is perhaps your greatest step forward in retraining and improving teachers. I think it is a good program if you push it. I think it will pay off.

Admiral RICKOVER. I am all for retraining teachers and giving teachers an opportunity to raise themselves educationally. But I am not too hopeful that you can take the products of our teachers colleges who have dutifully taken numerous dreary courses in "education" and who know little of the subjects they teach—that you can take such teachers and retrain them in these institutes. To my mind, a good teacher must first of all be a well-educated person, and you must start on that early in school. Then he must become a subject matter expert and finally he must learn pedagogy; he must learn how to transmit knowledge to children. Altogether too many of our teachers lack one or more of these qualifications. I am not sure you can make up the gaps later in life. It will depend on how intelligent a teacher is, how strongly motivated, and whether he has managed by his own efforts to become an educated person. In that case, a refresher course in his specialist subjects may do him a lot of good.

Mr. THOMAS. Massachusetts Institute of Technology has a group under the direction of Dr. Zacharias that has rewritten textbooks in math, physics, chemistry, and biology. I am sure you are familiar with that.

Admiral RICKOVER. Yes, sir. I am.

Mr. THOMAS. Do you think well of it?

Admiral RICKOVER. Yes, I do. It is one of the best things we have done to improve education.

Mr. THOMAS. So we are not doing too badly. There is room for improvement. If education is the foundation of progress—and I am inclined to think that it is—if we are so far behind, how is it we are feeding many of the countries of the world now?

Admiral RICKOVER. Mr. Thomas, you cannot judge the quality of a country's education entirely by material things, by how high a standard of living the country has.

THE FUNCTIONAL ILLITERATES

Mr. THOMAS. I think you can. The rate of illiteracy is high in many countries and I believe that you will find that those are the same countries that do not have a wealth of material things. Now, I am no educator, and I believe you have admitted a while ago that you were not one.

Admiral RICKOVER. Well, we spend more money on our school system per capita than anyone else in the world and yet we have more functional illiterates on a percentage basis than other leading countries.

Mr. THOMAS. What is that again?

Admiral RICKOVER. Functional illiterates.

Mr. THOMAS. I don't know about that. All I know is whether they can read and write.

Admiral RICKOVER. Let me explain: The President used this term. The President recently said we had 8 million functional illiterates. A functional illiterate is a person who can read letters of the alphabet, even words, but does not understand what he reads.

Mr. THOMAS. There is a lot of that in these countries.

Admiral RICKOVER. Most of the world is still illiterate, but the advanced countries of Europe—and I should think we would compare ourselves only with the best educated part of the world and not with Asia or Africa—these European countries have been wholly literate for at least half a century. The Annual Report of the Commissioner of Education for 1889–90, cited a study of the Central Statistical Bureau in Rome which they felt might "cause us some mortification." In 1887 among army draftees, such countries, as Germany, Switzerland, or Sweden had fewer than 1 percent illiterates. But in World War I we discovered to our dismay that almost a quarter of our soldiers were functionally illiterate, and recently the Army revealed that some 25 percent of draftees were not qualified to be modern soldiers for mental reasons.

A short time ago Mr. McMurrin came before Congress with some disturbing statistics. He submitted a table showing "the percentage of illiterates among persons aged 18 and over who completed less than 6 years of school"; in 23, or almost half our States, the rate was above 8 percent; in six States it was close to 20 percent. Mr. McMurrin asked Congress for a strong program to wipe out functional illiteracy. He remarked that in the past the principal cause of illiteracy was unavailability of schooling, but "in seeking the major cause of continuing illiteracy attention must henceforth be directed not so much to a lack of opportunity for any schooling but to a lack of adequate schooling." I think there can be no question whatever that continued use by our schools of faulty methods of teaching English—especially the "look say" method—account for this functional illiteracy. A study by the Council for Basic Education, *Tomorrow's Illiterates*, which came out last year, documents the cause and effect relationship between poor English teaching in our schools and the reading retardation of many perfectly normal children in this country.

NEEDED: LOCAL CONTROL OF EDUCATION IN THE UNITED STATES WITH A NATIONAL STANDARDS COMMITTEE

Mr. GARY. Traditionally in the United States we have followed the principle that education is a matter for the States and a lot of us feel that under the Constitution the operation of the schools has been reserved to the States.

Now as I understand it, you think we can do better if it is made a function of the Federal Government: is that correct?

Admiral RICKOVER. No, sir. I do not advocate that education be taken over by the Federal Government. Look, you have been handing out money for many years to our educational system. Your Defense Education Act provides Federal moneys for education. You give money to federally impacted areas. There has been some sort of Federal aid to education for many years. No, what I advocate is something else.

We have about 33,000 local school boards to manage our schools. No one knows or can find out what a person has learned in school or college by looking at his diploma or degree or going by the name of the school he attended—whether elementary, junior or senior high school, college, or graduate university. What I suggest is that you set up a small committee of eminent, scholarly persons who would be charged with working up specifications for certain educational levels, in the form of national examinations leading to nationally valid diplomas. This would be a standards committee. Every country abroad has national examinations.

> The United States—

writes Professor Bestor—

> is the one civilized nation entrusting its children to a public educational system that holds up almost no intellectual standards for them to meet.

We alone let ourselves be scared by talk of the glory of local control and the danger of Federal tyranny.

I suggest that this standards committee establish a permissive national standard, and see to it that it is at least as high as corresponding standards are in Europe. Nobody would have to pay any attention to this standard if they didn't want to. But those who met it would get some sort of national accreditation. The scholastic value of an accredited diploma for a college-preparatory high school course, or for a liberal arts bachelor's degree, or for teacher certification as perhaps for a high school English teacher would then be known to everyone in the United States and to educational institutions abroad. As it is, our academic degrees have no standing anywhere but are judged in each case by the institution that awards them.

This is not such a revolutionary idea as some educators would like the American people to believe. We already have a precedent in the college board exams. I would expand these exams to include many more types of examinations and I would finance the thing—it wouldn't cost much—out of public money as is done abroad. It should be a routine part of education in our public school system for children who want to prepare for and enter these examinations, as they do in England for the GCE, and as our young people who want to get into a good college now take the college boards. I would have such national examinations also for high school graduates who won't go to college. No, sir; I would not have the Federal Government take over our educational system.

Mr. GARY. You are advocating Federal standards.

Admiral RICKOVER. I advocate that we start with a permissive Federal standard. Something like the English General Certificate of Education examinations, or their examinations for ordinary and higher National Certificates and Diplomas or the new secondary modern school examination. These examinations are voluntary; the Government does not require anyone to take them. You don't have to take one to graduate from school. But in England you find it mighty hard to be admitted to a higher school or to get a good job unless you can show, by your performance in these national examinations, that you are educationally qualified for entrance to the higher school or for the job. The English think of this as a service they get from their government and they clearly like it. But our educators claim that when children must be prepared for an external examination, the school is put into a straitjacket and cannot freely plan its curriculum. I can best answer this by quoting the terse comment of a member of one of England's university examining boards:

> Being examined becomes irrelevant to the process of being educated *only* if it is agreed to be sufficient to expose the pupil to learning and undesirable to discover if there are any results.

England could not afford to follow the practice of many of our State universities that take in nearly all high school graduates and flunk out 40 percent of the freshman class at the end of the first year. I don't think we can afford it much longer.

So useful do the English find national examinations that at the moment they are working to set up a new examination to be taken by Secondary Modern pupils at the end of the fourth form; an examination below the GCE but which will be helpful for youngsters who want to become skilled craftsmen or technicians. It was the pupils themselves and their parents who requested the Ministry of Education to create an examination at Secondary Modern school level.

A national scholastic standard in our country would, I think, be very beneficial to our children; it would set them a goal to work for. It would be most useful to parents because it would give them a yardstick to hold up to their local school so that poor teaching could be easily shown up. It would give reality to our claim that we have community control of our schools at the local level. If the local people knew what a particular school actually *could* achieve, provided it tried to comply with the national standard, then they would have something to use against recalcitrant educators who prefer life-adjustment trivia to hard academic subjects.

It surely is not Federal tyranny to ask that a diploma give an honest description of what the holder has accomplished scholastically. We expect prime beef to meet Federal standards for prime beef. We demand that medicines and all sorts of foods carry labels that indicate their content. We do this to protect the public against being cheated. Well, honest labeling in education is just as important. The ordinary person is just as much in need of help when he tries to judge a school or a diploma as when he looks at a cut of meat or a bottle of medicine. Once you set a standard, products always tend to get better.

Mr. GARY. We are increasing our standards rather substantially. I have the privilege of serving on the board of trustees of a university at the present time and I am frequently called upon to vote for standards which if they had existed when I went to school I never would have been able to qualify for entrance and if I had been admitted I never would have graduated.

Admiral RICKOVER. I believe it has just been found that half of Harvard's class of 1945 could not have gotten in under the present admission standards.

Mr. GARY. I am in favor of higher standards.

Admiral RICKOVER. You say you are a member of a university board, sir. There are about 2,100 colleges and universities in this country and 33,000 school boards. So you have all these thousands of school and college board members working away, but not having any impact on any other school or college. What a lot of well-intentioned energy is wasted! In England and on the Continent when they find something new and good they have ways to apply it at once over the entire country. To carry news of better standards and achievements from school to school is one of the useful services of the English school inspectorate. A national standard-setting agency could do this, too.

Incidentally, I operate six schools and here is the way I run them: If I find something is wrong or needs correction I make the improvement instantly in *all* the schools. I do not take 100 years to do it. It took England a hundred years after they got started to get their school system to a point where it began to be comparable with the Continent. Now we are faced with a similar problem. We are coming more closely into contact with the rest of the world; we are going to have especially close relations with Europe, with the free nations of Europe. I am not talking of any political union, but there will be more and more areas where we are going to be working with them. And surely we want to make certain that the people we send abroad will be educationally at least equal to the Europeans they will be dealing with.

This is when differences in education are bound to show up. Already we are greatly inferior in knowledge of foreign languages; almost no one speaks a foreign language here. Recently the Common Market countries agreed to set up a common European school, mostly I believe, for the children of Common Market officials. It is a tough school—the usual rapid-moving European school, followed by their academic secondary school that leads by age 18 to 19 to their baccalaureate. Do we want our bachelor degree holders to be 3 years older?

Mr. ALFORD. Will the gentleman yield to me? I have had some experience in the field of medical education—I will say something that is interesting, first of all, that the Mayo brothers flunked out of the University of Michigan, as I understand it, Mr. Ford, and became two of the world's most prominent and outstanding surgeons. So, by standards of the University of Michigan, these two great Americans who contributed so much to medical science should never be—and I say that advisedly—you understand that is no reflection upon the University of Michigan, it is just a matter of interest. But according to standards, they would never have been able to contribute their great talent and abilities to the world of medical science.

Admiral RICKOVER. Well, sir, should we then make it a condition that only people who fail out of medical schools should be doctors? Would that be logical? Or should we abolish all medical examinations because once in a long while a man fails who later becomes an outstanding physician?

Mr. ALFORD. To turn to the basic issue, Admiral, I said that was a matter of interest. If you will yield further, Mr. Gary, if I may ask this question, what in your opinion can we do to return all public education—apparently from your original statement this morning that you feel that we should—to its proper sphere of classical and technical education and away from progressive education, which primary interest apparently is that of the cultive equality which you mentioned, teaching one-world socialism.

Admiral RICKOVER. I did not say anything about one-world socialism, sir.

Mr. ALFORD. But we are talking about the sphere of classical education versus progressive education, which we are indicting public education today, apparently.

VALUE OF TRADITIONAL CURRICULUM

Admiral RICKOVER. I am afraid I haven't made myself clear. In speaking of English education, I said I would like to concentrate on the technical task the schools must do and that I conceive this technical task to be transmission of a body of knowledge, development of the intellectual skill to apply this knowledge to the problems life brings us, and inculcation of the habit of basing judgment on fact, reason, and logic. I do feel that what we call the traditional curriculum—which nicely balances the humanities and the sciences and mathematics—that this curriculum brings about the result we should strive for. And that life-adjustment training will not.

THE FLEXNER REPORT AND MEDICAL EDUCATION REFORM

I would like to say something about medical education. Half a century ago we had mediocre medical education in this country. Whenever they could, American medical students went abroad for at least part of their medical education. Then the Carnegie Foundation asked Mr. Flexner to write a report on American and Canadian medical schools, and later on European medical schools. The last was the famous Bulletin No. 6, *Medical Education in Europe*, that came out in 1912 and sparked a fantastically rapid reform of medical education in this country. His report showed so clearly that our medical schools were inferior to those of Europe that it took the rug right out from under the feet of a lot of proprietary medical schools and they closed down one by one. I would like to see something on this order for our public schools. But unfortunately, our educators do not support this. The medical profession, as we all know, supported the reform effort enthusiastically and that is why we now have as good doctors as any in the world.

Mr. ALFORD. We are the leaders. The University of Michigan is one of the outstanding medical centers today.

Mr. CANNON. The gentleman from Tennessee, Mr. Evins.

Mr. EVINS. Admiral, I very much appreciate your testimony. I think you have contributed much to stimulating the interest in education in this country. I recall your testimony before this committee a few years ago and there has been great emphasis and advance in the field of education since that time. Our country is making significant progress and your contribution to this progress is immense.

As you have indicated, we are spending sums annually in research and development in many areas that contribute to the advancement of knowledge and education.

Admiral RICKOVER. I believe, sir, about $16 billion annually in the United States.

Mr. EVINS. The National Science Foundation has recently put out a report that in the last decade we have expended some $80 billion in research and development.

Admiral RICKOVER. I believe the Federal Government is spending about $11.5 billion annually. Of this sum, the Department of Defense is responsible for $7 billion, and other Government agencies for $4.5 billion. Industry is spending an additional $4.4 billion.

Mr. EVINS. This may be over a period of a number of years. In any event, we are spending great amounts of money in research and development.

We are also appropriating great amounts for grants for education. There may be a need to set up a grants committee to supervise the program.

NATIONAL SCHOLASTIC STANDARDS

Admiral RICKOVER. May I, with your indulgence, gentlemen, get back once more to national scholastic standards? If we had a national examination system in the United States, a permissive system, and parents were familiar with it, then they would immediately discover how well or how badly their children had been taught in the local school.

If the school had been spending a lot of time teaching children how to date, how to answer a telephone, how to set a table, and all the rest of that nonsense, they would be made to knock it off. If the school used unproved new gimmicks instead of effective teaching methods, parents would tell them to stop experimenting and get back to good teaching. In England, where children take national examinations at the end of the secondary school, the results are known. Every parent can judge what his child has been taught. If we had such examinations here, and I mean for every level of schooling, then if children in a particular community consistently did poorly in these examinations; if there were a real pattern of general failure, you would get a big outcry and pressure would be put on the schools by parents and the community. People would demand to be shown why their Johnny can't read, why he failed the English test and so on.

THE ENGLISH NATIONAL STANDARDS FOR TEACHING: IMPLICATIONS FOR THE UNITED STATES

There is another English practice that is good. This is rather fragmentary testimony, but it necessarily has to be this way. They have a national salary scale for teachers and this helps even out geographic inequalities. The teachers have their national professional associations. Machinery has been set up—the so-called Burnham committee—through which these associations and the employers of teachers, the local education authorities, negotiate salaries. The Burnham committee works out a salary scale that gives teachers with the same educational qualifications the same salary throughout the country. This protects the poorer local districts against losing their good teachers to districts where salaries are higher.

Some of our States have a staggering problem of teacher turnover. For instance, in the 6 years from 1954 to 1960 over 9,000 teachers quit their jobs in West Virginia, yet the State's entire teaching force is only 15,000. The situation is becoming worse. These geographic inequalities would exist in England too, were it not that the Government adjusts its grants-in-aid to the financial needs of local communities and that it has helped to set up this machinery for arriving at a national teachers salary scale. I cite this to point out how beneficial national standards can be. To call them "federal tyranny" misreads their purpose and nature.

Two years ago I visited a school near St. Louis, near Mr. Cannon's district. In this school which serves a well-to-do community they were paying their teachers 30 to 40 percent more—perhaps even higher—than teachers were being paid elsewhere in the State. Naturally they were able to get good teachers. When you have a national standard for a teacher's professional qualification and in addition a national salary scale which bases a teacher's salary solely on these qualifications, then you get a situation where poorer areas are not penalized by not being able to afford good teachers for their children. You can leave the actual hiring of teachers to the local community so they will get people with the personality traits they like; the kind they think will be good teachers for their children. But they would choose these from a pool of teachers who all had proper professional qualifications. The teachers themselves could then accept a position or not without being influenced by financial considerations; the pay would be the same everywhere. This is the situation in most other advanced nations.

I don't know whether it would be possible to have a national salary scale for teachers in as large a country as ours, with such great differences in assessed wealth in our thousands of independently managed school districts. But once we had a national standard for teacher qualification, it would be easier to approach uniformity of salaries. By adopting something on the order of the English system of adjusted grants-in-aid, the Federal Government could help immensely to raise overall education achievements.

Certainly, as Mr. Thomas said, there has been improvement. But it has been spotty. And even where progress has gone farthest, it still has not gone far enough. Our geographic inequalities strike me as completely undemocratic. All our children ought to have equally good educational opportunities so that what they achieve will be solely a matter of their own ability and application and not such a fortuitous matter as where their parents live.

Mr. EVINS. I read a report recently that some 10 years ago one of of our States had about 25 percent of its teachers who had a basic degree. Now 50 percent of the rural teachers in this State have an M.A. degree.

The teachers in our better financed centers—in the cities—have a higher percentage of educational advancement—90 percent of them have degrees. So we are making progress.

Admiral RICKOVER. We have a hundred thousand teachers who have not even been to college.

Mr. EVINS. But we are making progress.

Admiral RICKOVER. We are making some progress, sir. Of course, there is progress all over, but the question is whether our progress is sufficient to keep us in advance of the requirements.

I maintain it is not.

Mr. ALFORD. Would the gentleman yield? I do not want to belabor the issue. I want to point this up. I am sincerely interested in this because I think you have struck the very basic problem, but we are in difference in our definition of terms.

We are talking now about masters degrees and degrees of teachers, but we were originally a few minutes ago, earlier in your remarks—and I was in complete agreement with that, Admiral—that we are talking about the teaching of the basic classical and technical subjects.

Admiral RICKOVER. Yes, sir.

Mr. ALFORD. Some of the greatest teachers in this country have been those in the schools in the early days of this country. They had no facilities for teaching underwater basket weaving, for example, or cosmetology in high schools. Therefore, they were relegated, Mr. Chairman, to nothing but reading, writing, and arithmetic and the classics, but we have gotten away from this through our increasing our standards in some of our teachers with their degrees. They are the ones who are the greatest advocates of the social welfare type of education, which is taking us more and more away from what you are advocating, Admiral, it seems to me.

Admiral RICKOVER. Of course, I agree with you we should not have all this psychology and sociology in our schools; school age children simply are not capable of understanding it. So it becomes a form of indoctrination and propaganda. The educational system in this country appears to be based on the idea that the schools must bring about a leveling of all children by holding the bright ones back.

But just because the teachers' colleges went over to the progressive theory of education should not, I think, induce us to lower degree requirements for teachers. These requirements still are inferior to the scholastic and professional requirements European teachers in every type of school must meet. Again, I would like to stress that if we had a national standard set by a small committee of distinguished scholars, we should eventually get better teachers for every school in every district, no matter how backward it might be economically. This is what you find abroad, where nobody says it is tyrannical to have national teacher certification standards.

COMPARISON OF EDUCATIONAL ATTAINMENT: UNITED STATES AND EUROPEAN

It's all these so-called experts, these people who aren't very intelligent and who aren't well educated but who have had a smattering of sociology and psychology at college, who are constantly urging that children be kept in school longer and be given higher degrees. Since the end of the war, the official dogma of the educationists has been that 50 percent of our youth has a right to go to college. Yet we only manage to get 50 percent of the 18-year-olds through high school and many of them are not doing any genuinely secondary schoolwork there. So if you insist half our children should go to college, you will simply be calling a vocational or continuation elementary or perhaps what the Europeans call a lower secondary school—you will call that a college. As you lower standards you lengthen schooling. This is a treadmill, not progress.

In 1961 we got 23 percent into college and according to past experience we may hope that about half of those will obtain some kind of bachelor's degree. In all too many instances this degree will, however, be scholastically below a continental baccalaureate or a good English "advanced" and "scholarship" level GCE. Our education statistics are therefore wholly misleading when they claim we have 25 percent of our youth in "higher" education compared to 5 or 6 percent abroad. They are comparing American college students with European university students and the two are about 3 or 4 years apart.

Our education statistics are very confusing because they pay no attention whatever to the quality of a particular level of education. They just mechanically equate schools by the age of their graduates. I can tell you this, Mr. Chairman, I have for years read the official figures put out by our Government statisticians and I defy anyone to make much sense out of them—even anyone in this room and you are used to questioning people and reading statistics. They do not add up. They do not make sense. I think it is a reflection on the kind of people you have had in the U.S. Office of Education.

OUR EDUCATIONAL STATUS QUO

The other factor that makes it difficult to make progress in American education is the large vested interest that favors maintaining education as it is, that is, maintenance of the educational status quo. You have teachers and administrators and coaches and counselors and so on who don't like or want change. You have the 800,000 members of the NEA, I would suggest they be called NEPA, National Education Protective Association. This is a powerful lobby, supported out of the dues of teachers and other school people but run for the most part by school administrators. In practice NEPA, I mean NEA, sets what standards we do have and they are mostly the wrong kind: how long children should remain in common core programs and what they should study together there, et cetera. You have this close association between NEA and the Office of Education—you have had this in the past at any rate. People move from one to the other. The last Commissioner of Education went over to NEA, for instance. So you have the same people being judge and judged. And anybody from outside who criticizes our schools is called stupid, ignorant, sinister, et cetera.

Mr. CANNON. Mr. Natcher, of Kentucky.

Mr. NATCHER. Some people in this country, Admiral, believe that our educational system should be changed to the extent that every child will receive an education fully adequate, according to his or her ability. In the process——

Admiral RICKOVER. I do, too, sir.

DEMOCRACY AND EDUCATION

Mr. NATCHER. In the process, those unusual children from the standpoint of ability and intelligence will be guaranteed from that point on, through grants or other methods, of a full and adequate education. In other words, carefully educating our future leaders. Do you believe, Admiral, that either at the local, State, or Federal level, changes should be made to see that we educate the future leaders of this country to the extent that none of them are lost and dropped by the wayside?

Admiral RICKOVER. I don't somehow like the idea of a school setting out to educate our "future leaders." I think a school should try to develop each child's potentialities to their utmost. That means giving talented children the kind of tough and challenging education they need to reach their potential. If this is what you mean I agree wholeheartedly with you. My creed is a simple one. Every American child, wherever he may live, whatever may be his religion, race, social origin, every child should get an equal opportunity at school to become educated up to the highest level he is able to reach. That is as far as we can go. That is as far as I believe we can "democratize" education. Education just isn't something that can be handed out in equal shares to everybody. You have to work to become educated. Society can only offer you the opportunity. You yourself must transform the opportunity into the achievement. So to say that every child has a right to a high school diploma, or a right to a college or university education makes sense only if what is meant is that the child should be given the *opportunity*—the same opportunity every other child gets; that he shall not be denied the opportunity because he is too poor to pay the cost of his education; that we will socialize the cost. "We must dream of an aristocracy of achievement," said Jefferson, "arising out of a democracy of opportunity."

Most progressive educationists are muddled in their thinking about democracy and education. Democracy is a political philosophy, it is a form of government. It means rule by the people or, to quote Madison who puts it so clearly, it is a government that—

> derives all its powers directly or indirectly from the great body of the people, and is administered by persons holding their offices during pleasure, for a limited time, or during good behavior.

Now it's one thing to say as we do, that every citizen has an equal right to elect the men who govern him, an equal vote, and that he is equal before the law, but quite another to say that each child has a right to an equal education. You can't carry equality into areas where rights must be *earned*. Our political rights were earned by earlier Americans in the past. But the right to a good education must be earned by everyone for himself.

Suppose you have studied law and I have studied nuclear engineering. How can you be equal to me in nuclear engineering, how can I be equal to you in law? Or take Van Cliburn and myself. He plays the piano marvelously and I am quite unmusical, so he is superior to me in music and I presume I may be superior to him in engineering.

We have been making a cult of the average. A national magazine a while back tried to compare the amount of education the "average" American and the "average" European child gets. This makes as little sense as talking of average American athletic ability, or musical ability, or ability to paint. Then if you wanted to set up a school for future athletes, musicians, and painters you would make that average figure the norm for the school. This is what we do when we talk of equal education for all.

EDUCATIONAL NEEDS OF ACADEMIC CHILDREN

Some people have better physiques, some have higher artistic talents, and others have greater intelligence than the rest of the people. These are special gifts and a public school system should be broad enough to cater as adequately to young people with special gifts as to those who have no special gifts. We should give every child an equal chance, an equal opportunity to go ahead at his own pace; I would see to it that he has good teachers and that the school does its technical job properly. I surely would never hold a child back who has a better brain.

When you talk about people with different IQ's, you necessarily have to talk in broad generalities. You talk statistically. Human beings can never be completely categorized; there will always be the exceptions. For example, the Mayo brothers who failed out of Michigan. You can't take an exceptional individual and make him the norm. Of course, you have to try to do justice to people who depart from the norm. But it would not make much sense to take the Mayo brothers' case and conclude that therefore the ideal doctor is one who flunks out of medical school. I could quote the old cliche about the exception proving the rule.

The work that truly advances the world is done by a handful of people. It is done by people with outstanding capacities, more often than not these are intellectual capacities. To get back to this IQ business: Really high IQ people are extremely rare and they contribute enormously to the general welfare. Or at least they have it in them to contribute much. It is estimated that about once every 500 years you may get a man like Archimedes or Newton or Gauss. They are believed to have had an IQ of about 190. It has also been estimated—and these are very rough figures and I would not want them to be taken as exact figures—that there may be 12 people or so with IQ 180 alive in this country today, people on the level of Darwin, Freud, Shaw, Pasteur, Einstein. There is a great difference between a man who has an IQ of 140 and one with 150; also between 150 and 160 or 160 and 170. A man with an IQ 180, for instance, is capable of ideas and discoveries that could not be duplicated by dozens of people with IQ 170, not even if you gave them every facility and they worked harmoniously together as a team. It takes a Newton or an Einstein to come up with ideas and discoveries that revolutionize our whole concept of the universe, of science. And this is true in other fields as well. Take a child with average musical talent. He could spend his entire life practicing the piano under the best teachers yet not even at 60 would he be able to produce a composition of the musical quality a Mozart produced at 6.

Our schoolmen seem incapable of grasping that this is as true of intellectual as of musical or artistic talent. They are blinded by their mania for making the average the norm, in the name of democracy in the schools. In contrast, the people who run European public education, who are themselves above average in intelligence and education, have no trouble recognizing that there is a cutoff point in the intelligence scale and that children with IQ's below that point will find it virtually impossible to absorb an English grammar or a French *lycée* or a Swiss maturity education, no matter how many years they might stay in school.

What the IQ measures is of course a specific type of intelligence, the kind essential to academic studies. There are other mental qualities not measurable by intelligence tests; practical intelligence for example. But in order to pursue the program of a European academic secondary school you need academic talent. The *Princeton Alumni Bulletin* last February defined it as—

> ability to absorb specialized knowledge out of books and to apply it to the concrete, * * * ability to form sharply defined abstractions, to manipulate them and to perceive subtle relations among them.

This is a talent possessed by a minority, but it—

> is an extraordinarily important type of intelligence, lying at the root of all science, scholarship, the professions, and the academic disciplines—of all the fields in which our country now has disastrous shortages.

We have these shortages because in our public school system we make no provision for the educational needs of academic children. European educators do not feel that a public school system to be democratic must deny this minority their appropriate education. And so they have the tough academic secondary schools which receive the same public support as do other, less difficult secondary schools.

SOME AMERICAN EDUCATORS' CRITICISM OF EUROPEAN EDUCATION

When American educationists go abroad to judge European school systems, all they note is the alleged "unfairness" of not admitting all children into these academic secondary schools. They never stop to think that in our own public school system nobody gets into a school that would be the equivalent of these European academic secondary schools; we simply don't have such schools in our public school system. Instead of recognizing that our failure to provide such schools is a defect of American public education, they castigate school systems abroad for providing academic secondary schooling for a minority of children only. Yet it is only this minority of children who can and will absorb the challenging programs of these schools. I have great difficulty understanding the educators' confused thought process which makes a virtue out of our deficiencies.

Earlier I mentioned a publication of the Office of Education called *Education in England* which came out in 1961 and consisted of five studies of the English school system by American professors of education. Included in the publication are the comments of two English educators. While they gave credit to our professors for accuracy in detail they pointed out politely but firmly that a wrong idea of English education had been conveyed because the American professors judged everything by the criterion of their own peculiar notion of democratic education. Separation at the secondary level was to them undemocratic, class biased, wholly unacceptable. As one of the English educators remarked—

> they seem to be almost obsessed by the idea that England is a class-ridden community, and their "interpretation" of our educational system is dominated by this one idea.

As a result the Americans relied in many cases on "sources that are scarcely representative," especially on research carried out before the full effect of the 1944 Education Act had made itself felt, and they left out the most important aspects of English education.

American educators assert it is not possible to learn *anything* from education abroad. May not their inability to learn be a reflection on the educators themselves? Particularly since every thinking American now knows that we must upgrade our educational system to hold our place in the world. We are willing to learn in matters other than education. The fact that we are the most powerful and advanced industrial nation in the world has not prevented President Kennedy from sending people to Europe to find out why their economics are booming, why their industrial growth rates exceed ours and why there is almost no unemployment abroad.

Quite a few American educationists have been visiting abroad. That they have carried back no ideas to help us solve our educational crisis is due to their one-sided viewpoint on education. This one-sidedness, I believe, springs from their instinctive dislike for the "fortunate deviates", as they call our bright children. There is no teacher abroad who is not delighted when he discovers unusual talent among his pupils; who will not do all he can to encourage this talent and help it on its way. But here the very bright are looked on as administrative problems, on a par with the lame and the halt. Perhaps the liking of our educators for the average is a measure of their own ability.

I am convinced that little worthwhile will be accomplished despite all our efforts to improve the schools until more intelligence has been infused into educational officialdom. The present leadership in public education lacks that all-important quality any leader in any area of modern life must have—an outstanding mind that has been nurtured, disciplined, and polished by a challenging education. All you need do to see that this quality is missing is to read the stuff our schoolmen manage to get published—the stuff that students at teachers colleges must "digest."

I think we should give every American child an equal opportunity to become genuinely educated. Whether he seizes this opportunity or not is up to him. And since we have far too few bright children—no country has enough—we should certainly not waste their time by holding them back so the school will be "democratic." We have abandoned the old European concept that talent should be encouraged and helped, and it seems to me high time we got back to this fine idea, an idea entirely compatible with democracy.

Mr. CANNON. Mr. Denton, of Indiana.

TEACHERS' SALARIES IN EUROPE

Mr. DENTON. How do we compare with Europe with regard to teachers' salaries?

Admiral RICKOVER. Their salaries in dollars are lower than those of American teachers—a reflection of a lower salary standard all around, of less national wealth in general. But in relation to salaries of other professional people they are higher. In Switzerland, for instance, a teacher in the middle range of the secondary schools may earn about 18,000 francs; in the higher range of the secondary schools he may earn 22,000 francs. These are good salaries by Swiss standards, though below those of a successful city lawyer who may earn about 30,000, or a first-rate physician who may make up to 50,000 francs. The highest Government officials get about 65,000 francs. No country really pays its teachers what they are worth, but abroad they do range with professional people. Here we lump teachers together with firemen and policemen.

To repeat: Our teacher salaries are higher in dollars, lower in relation to the income of other professional people.

Mr. CANNON. Mr. Santangelo, of New York.

THE FUNCTION OF EDUCATION

Mr. SANTANGELO. Admiral, as I understand your position, it is that the function of education is to develop the intellect and all these frills should be eliminated.

Admiral RICKOVER. That is the function of schools. Education is a very broad subject.

Mr. SANTANGELO. Is not the function of the school to develop the intellect?

Admiral RICKOVER. Yes, sir. Home, church, and community have a part to play in the education of children, too.

Mr. SANTANGELO. You have indicated that there are certain activities and courses which are extraneous or irrelevant, and diverting the children from their true pursuit.

I would like you to set forth if you can what courses and what activities you would eliminate from the elementary schools, the high schools, and colleges and what courses and activities you would retain.

Admiral RICKOVER. I believe that there are about 300 courses now in our schools. I cannot give you a complete list but, for example, I would not use time at school to teach children how to handle a telephone.

Mr. SANTANGELO. Then tell us those things which you would retain.

Admiral RICKOVER. That is easier. I think there are about 12 basic subjects I would retain in the public schools. The first and the most important is English.

I see that my friend Mr. Taber is leaving this hearing. I understand he does not intend to return to Congress next year. I am sorry. He has been a great friend of mine all these years. Mr. Taber, I would like to thank you very much, sir, for all you have done for atomic power for the Navy and for civilian purposes.

Mr. TABER. I am very glad to be with you.

Mr. CANNON. The gentleman will proceed. Mr. Santangelo.

Mr. SANTANGELO. I was in the process of getting an answer from the Admiral.

Admiral RICKOVER. Would you wish me to try to list the subjects I consider essential in a good school system? If you wish I can include them in the record.

Mr. SANTANGELO. I would appreciate it. I would like to know exactly what subjects you are advocating should be taught and which should be eliminated.

Admiral RICKOVER. I will do so.

Mr. SANTANGELO. Thank you.

SUGGESTED BASIC COURSES

Admiral RICKOVER. I will try to answer the question as to what subjects I would include in the school curriculum. As a minimum, as the rock-bottom minimum every American child needs, I would have English, to be studied intensively and given the major time block in the curriculum. Next, mathematics. Every adult American needs to know arithmetic to be able to handle percentages, interest, and have some elementary knowledge of plane and solid geometry. I would give this the next biggest block of class time. Then I would go very thoroughly into American history, especially the growth of democracy, how our Government works, what are the duties and rights of democratic citizens. I would make sure every child knew the geography of the Western Hemisphere thoroughly and had some idea of world geography. I would teach all children the elements of science.

I would allot two class periods a week each to music, to drawing, and, for manually gifted children, to some sort of shop or commercial or domestic course. But these nonacademic subjects would get no more than 15 to 20 percent of the class periods. Everything else would be basic education. And the less academically talented a child is, the more would I concentrate on English and mathematics so he would at least attain a modest literacy and numeracy. By literacy I do not mean being barely able to read and write but having some knowledge of literature as well.

For abler children, I would have at least one, preferably two, foreign languages, each carried for one class period every day for a minimum of 4 to 5 years. And the same amount of class time for higher mathematics and for science studied separately as physics, chemistry, and biology. I would insist they study ancient and modern world history, as well as world geography, with special emphasis on our own place in history and our particular geographic position in the world. I would ask that all children do a lot of reading in literature, in biography, and history.

I would at every ability level try to lay a good foundation from which children can take off on their own and continue their education through life. I would try to give them the basic tools to do this. But I would not teach them subjects that *can* be mastered through self-education when the interest is there. As archeology, or journalism, or sociology, or psychology; these are specialist subjects. If you are interested you can learn them on your own. But it is extremely hard to self-educate yourself in adult life in mathematics or in mastery of your mother tongue or of a foreign language or science.

LIFE-ADJUSTMENT EDUCATION NOT BASIC

The world, as the poem has it, "is full of a number of things," but not all of them are essential to the making of an educated person. To sum up: I would exclude from the curriculum everything that can be learned elsewhere, that a person can learn on his own, that he can get out of magazines and television commercials. How to be well-groomed, how to keep your teeth clean, how to dress becomingly, and so forth. How to set a table, or entertain at a party, or arrange a wedding. Courses in "home and family life," installment buying and budgeting family income. How to be "likable, lovable, and datable," how to use the telephone, order meals in restaurants, catch fish, manage a trailer camp, and so forth.

In sum, I reject in toto the U.S. Office of Education concept of *Life Adjustment Education for Every Youth* contained in their pamphlet of that name. I reject the notion that 60 percent of American children cannot absorb a basic education and must therefore be given life-adjustment training. I reject the idea that not only these 60 percent but *all* American youth must be given this life-adjustment training. I think the so-called "common learnings" that are the main part of this life-adjustment training, including core courses on "home and family life," "self-realization and use of leisure," and "consumer education" are matters that should be learned elsewhere, if at all. When such subjects are allowed to take up a good part of the child's time at school, the school falls down on its technical job.

MANY CURRENT EFFORTS TO IMPROVE EDUCATION QUESTIONED

I am not overly optimistic about current efforts to improve American education. The reason I have doubts is that what is being done necessarily reflects the thinking of the very people who got us into the educational crisis with their life-adjustment training and their progressive theories. These people still run our schools. Like administrators the world over, they tend to be overly impressed by mechanical gadgets, by little boxes with slots that will teach you geometry in a weekend or French in a month. This whole new fad of machine teaching reminds me of nothing so much as the advertisements you used to see where for a few dollars you would get a record or a book that would teach you to play the piano or speak a foreign language. "I used to be a social wallflower. But last night I surprised all my friends by sitting down at the piano; or by talking to the foreign visitor in fluent Spanish. You too can be a success. Send the enclosed coupon and x dollars." Or, as a recent advertisement for a book claimed, "from kindergarten to college in 5 years." The trouble is that there are no gimmicks in genuine education. It takes an intelligent, well-educated teacher with a gift for inspiring young people to want to learn, and no machine can do this.

Now a little while back we discussed the new textbooks being written by university scholars. My pleasure that this long overdue step has finally been taken is tempered by knowing that the same people still run our schools who but a few years back would have nothing to do with subject specialists; who were bitterly opposed to letting the college influence the high school in any way whatsoever. Take the study put out by the Association for Supervision and Curriculum Development of the National Education Association, entitled *One Hundred Years of Curriculum Development, 1857–1957*. That study appeared just a short time ago and the people who wrote it and who ordered it to be put out are still in our educational establishment. And here is what these people wrote:

First they described the deplorable situation existing in the benighted days before Dewey, when the curriculum, as they noted with horror—

> was organized according to the logic of a field, content was selected largely by experts in that field. Physicists wrote the text on physics; literature was selected and interpreted for high school pupils by college professors; mathematicians decided on the order and content of arithmetic tests; and so *the experts dominated the content of the curriculum.*

Fortunately, so the study goes on to say, such ridiculous ideas as that a physicist should determine the physics content of a high school curriculum have long since been abandoned. Today "experts in method and content" help "give breath and vision" to curriculum revision. And furthermore, in accordance with "the philosophy of democratic participation and the recognition of the dynamic nature of learning," the pupils themselves "set the goals, plan the activities, and evaluate the results of their work," gently led, I suppose, by teachers who in progressive terminology go by the term "resources persons." Mind you all this nonsense was said by these "authorities" as recently as 1957.

Can a leopard change his spots? Can a progressive educationist become a good teacher of the basic subjects that alone will make a good school program? I hope so. I am all for setting up institutes to retrain teachers. I am all for getting specialists to rewrite textbooks. All I say is that we must make certain the educationists aren't just saying nice words; that something is really being done in our classrooms to improve our teachers and the instruction of our children. This is why we need a national scholastic standard.

Mr. CANNON. Mr. Lesinski, of Michigan.

Mr. LESINSKI. Admiral Rickover, I am assuming from your remarks that you are proposing that we have a qualitative educational system, not quantitative.

THE EDUCATION OF EVERY CHILD TO THE MAXIMUM OF HIS ABILITY

Admiral RICKOVER. I do not know what you mean, sir. I mean to educate every child to his maximum ability.

Mr. LESINSKI. Right, but the point I am driving at is not just to grind out kids out of school, just to get them through school is not proper. You should teach them something.

ADVANTAGES TO LENGTHENING THE SCHOOL DAY AND YEAR

Admiral RICKOVER. Yes indeed, sir. I have never been able to understand why the educators are so proud that we keep our children in the classroom more years than any other nation. This is no advantage unless they are taught more in these additional years. But this is just the point I have been making for years. They don't learn more.

We have too short a school day, too many interruptions during class periods; too many extracurricular activities disturbing school work. Then we have too short a school year. It is only in the last decade or so that 180 school days per year has become the norm here. UNESCO recently made a study of comparative class instruction time per school year. Of 51 nations, 37 had more class time per school year than we, and that included virtually all of Europe. In England which is closest to us in this respect though well behind Europe, the school year still has about 20 percent more class time.

All this goes back to a time when we were largely rural, and children were needed on the farm during the summer. But we are now 70 percent urban, and getting more so every year. Air conditioning is available and children could well go to school just as long as they do abroad. If we were content with letting our children have 2½ months vacation—wouldn't that be adequate?—we would have 210 school days; if we cut out homeroom study periods and devoted the whole time from 9 to 3 to class instruction, except a half hour for lunch, we would add 10 to 15 percent more to the school day. Combined, this could give us almost one-third more class instruction per year, so that in 9 years we would gain 3 extra years. Just by bringing the time our children spend under instruction in school somewhat closer to what is customary abroad, our children could by age 15 have had as much schooling as they now get by age 18. And the million a year who drop out early would at least have obtained the equivalent of a high school education. Teachers would be fully employed the year round instead of having to take all sorts of nonteaching jobs to eke out their income. Overall we would save money and what is far more important our children would save time. And, on top of it, we might be able to get better teachers.

One consequence of our educational stretchout is that we need proportionately more teachers than are required abroad to get the same results. That is, to provide a specified number of hours of class instruction takes Europeans fewer school years, hence they get by with fewer teachers. We needlessly inflate our teacher requirements. The stretchout makes it necessary to have so many extra teachers that we cannot have as good ones as they have abroad. There just aren't that many intelligent people in *any* country who can be induced to take up teaching. We currently have 90,000 substandard teachers, substandard by our already modest standards. We have nothing to be proud of in the stretchout that makes us the country where children stay longest at school. It is pure inefficiency. Strange that we, who ordinarily admire efficiency, actually feel proud of taking more years to educate our children than do other countries—as if the mere act of sitting in class were in itself something wonderful, a part of our high standard of living.

MONEY ALONE INSUFFICIENT TO SOLVE EDUCATION PROBLEM

When I began to study education about 10 years ago, I thought that paying higher salaries to teachers would solve all our education problems. I thought money was the answer because everybody thinks money is the answer to every problem in the United States. I was quite popular with the educationists as long as I talked about getting them more money. In fact, one year I was even given a citation. But when I started looking deeper into education I found that money was not the whole trouble; that school objectives, school curriculums, teaching methods, the qualifications of the teachers, the predominance of nonteaching administrators, that a lot of other things were wrong with education. I wasn't popular any more after I started talking about these defects in our school system. I was shocked when I found that in Florida, for instance, 60 percent of school principals are former coaches, and that in California, 70 percent of the school administrators majored in physical education. When I started finding things of that sort I realized it was not just money alone.

Mr. ALFORD. Would the admiral say that again, 70 percent——

Mr. CANNON. Mr. Ford, of Michigan.

Mr. FORD. We have had in recent years, and it seems to me accentuated now, a trend to counseling. We are getting repeated requests to fund counseling through Federal grants and the local people are being called upon to increase their contributions to public education, to increase counseling.

What is your observation on counseling?

OBSERVATIONS ON TEACHING AND COUNSELING

Admiral RICKOVER. I feel about counselors as I feel about school administrators who are not themselves qualified teachers. I think all these jobs could be done much better by good teachers.

I keep coming back to the point that in a country such as ours, schools must concentrate on their technical task. The reason why we have to have schools is that our children need a good deal of basic knowledge, a good deal of training in making use of knowledge; they need to learn to respect fact, logic, and reason. They need all this if they are to live successfully and be useful as individuals, as breadwinners, and as citizens. To prepare them for adult life by trying to develop in them these abilities is, to my mind, the purpose of our public school system. This it *must* do. It might do many other things if it had the time but I maintain that it does not have the time during regular class hours. If other services are considered important, I suggest they be made extracurricular and not imposed on our teachers.

The teachers and the teachers alone can perform the school's technical task. The quality of American education depends on the quality of our teachers. Hence we ought to do everything possible to help the teachers become a corps of genuine professionals. This means better education for them, as well as higher standing in the community, and it means most particularly that nobody ought to be given any position in school management who is not a qualified teacher himself and who has not actually practiced the teaching profession. I repeat that we are the only Western country with so little respect for teaching as a profession that we allow ex-coaches and so-called school administrators with degrees in administration to boss the school faculty.

I urge that the clerical, plant supervision, purchasing, and other nonteaching functions of schools be recognized as vastly simpler than teaching, requiring persons of far less intelligence and training. Hence these services ought to be performed by administrative assistants to the principal or superintendent of schools, who himself should in all cases be an outstanding teacher.

As for counseling, I think that if children need psychiatric help it should be furnished by a licensed physician who has specialized in psychiatry. We now have dental and medical service for school children; psychiatric service should be part of this medical care we provide for them. As for counseling normal children, I submit, if it is to have any real value it has to come from the teacher who knows his pupils, knows their capacities, and who is the one person best fitted to give them advice on further education and career choice. Here again there are simple clerical chores to be done and these should be done by counseling assistants working under the direction of the teacher. In many schools, college counseling consists almost wholly of supplying students with college catalogs and giving them information on admissions requirements. The trend is now toward basing admission in good part on a student's performance in some external examination—the college boards, and so forth. It is the teacher who prepares students for these examinations; he alone is able to judge how students are likely to do in the exams. For this reason he is the person who can best advise students in this matter.

CRITICISM OF SCHOOL'S PUBLIC RELATIONS PRACTICES

I think you know that American education is the most expensive in the world per child; the sad thing of course is that so little real education is bought with all this money. It is so expensive partly because of the stretchout I have been talking about. Of course it costs more to give a child an elementary level education if this takes 12 years, as it often does here, against 8 years, as it does on the Continent. But a good part of the higher cost of American education comes in through the enormous administrative overhead we have, the large numbers of nonteaching staff our schools employ and that includes these counselors and the athletic coaches and the mass of clerical people to take care of all the paperwork. Nothing has ever been seen in all the world as the amount of paperwork it takes to get one little American child through the public schools and into college. But the weirdest cost item is the school or college public relations staff.

I found I could never explain this aspect of American education to foreign educators; it was to them wholly incomprehensible. To hire someone to give out straight information—yes; they could see that was necessary. But obviously that is not what public relations staffs are hired for; they come too high to be used merely to hand out information. What is expected of public relations people is that they will project a favorable image of their employer by emphasizing what is favorable and omitting what is unfavorable about the employer's performance. To my mind, any educational institution owes the public "the truth, the whole truth and nothing but the truth," not something just a little less than the full truth.

What seems to me particularly objectionable is for educational institutions paid out of public money to use public relations practices when their performance is subjected to criticism. They are not exempt from the scrutiny of their employer, the American people. Nor are they exempt from criticism by individuals who are seriously concerned about their work. Such institutions owe it to the American people to reply factually to criticism. For them to deal with critics on the public relations pattern—that is, by discrediting them personally, claiming they are ignorant, uninformed, self-seeking, axgrinding, and so forth—that seems to me wholly unacceptable. Every public agency must answer serious charges made against it. It is after all the servant of the people who in our country are the sovereign. A servant owes his master the truth.

WAS EDUCATION BETTER IN THE UNITED STATES 50 YEARS AGO?

Mr. FORD. Do you think that our public and private school systems in the United States were better run and gave a better education 50 years ago than now?

Admiral RICKOVER. Well, I notice that for years there have been complaints by employers that high school graduates can't perform simple clerical duties requiring elementary skills in English and arithmetic; by colleges that freshmen can neither read, write, nor figure with facility. Even professional schools complain that students who have received bachelor of arts degrees are deficient in English. Dr. Robert B. Davis of Syracuse University once made the pungent remark that our public school system is afflicted with—

> creeping lowest common denominatorism—

and Grayson Kirk, president of Columbia University, has stated that—

> our secondary schools were infinitely better 90 years ago.

A few years ago it was reported that a graduate from a junior high school could not read the words on his diploma.

THE NEED FOR A COMMITTEE TO FORMULATE NATIONAL SCHOLASTIC STANDARDS

That is why I keep urging that you set up a committee to formulate national scholastic standards. These standards would be permissive, but I think they would, just the same, persuade many schools to raise achievement goals. Public opinion would make this advisable. Higher achievements thus reached in the public schools through national standards would spiral upward to raise levels in college and university. At present the mediocrity of our public school system holds back our higher education. As President Griswold of Yale wrote, how can the college do its job when in the public schools—

> students are crowded and hustled through undisciplined classrooms, taught by overworked, underpaid, and inadequately trained teachers, and nurtured on subjects that do not constantly stretch their minds and enlarge their vision?

When the schools send such poorly educated students to college "it is illusory to believe," that—

> either the liberal arts colleges or the graduate and professional schools of universities can maintain their standards.

Higher education—college and university education—is innate in Western civilization. We cannot do without it. If we fail in education we are likely to fail in everything. "The whole complex must first be perceived by society and understood for what it is," warns Griswold. "The mind and spirit of American democracy is in danger of its life."

Much is made of the fact that our high schools now cater to a broader range of intelligence than they did in the past. Apologists for our schools always use this to justify lower achievement levels here compared to abroad. There are two things to be said in reply:

First, it is quite true that a high school embracing children through the whole normal intelligence range will function at a lower overall achievement level than the pre-World War I high school which was then still largely college preparatory. This merely underlines the point I keep making over and over again. You have to separate children in secondary school if they are to be educated in accordance with their capacities and needs. The bright, the average, the slow learners will all progress faster when they are grouped in such a way that every pupil in the classroom is able to participate in the schoolwork going on. But this the educators will not accept. So it is entirely their fault that the high school has deterioated scholastically.

Second, even as mass education, the schools are scholastically below par. They are in my opinion even too low in their standards for average children. In many cases, the fault lies with progressive dogmas, such as the "readiness" dogma that postpones and postpones the moment when our children get into real studies. Abroad the same type of children, in equally comprehensive primary schools move ahead faster. Over the years the progressives have moved subjects into the next higher grade so that what used to be learned, let us say in the fourth grade, is now learned in the fifth. It is entirely the fault of their teaching methods and dogmas that from the first day he goes to school the American child drops behind children abroad.

How greatly the progressives have underestimated the absorptive capacity of American children is clearly shown by the fact that under public pressure, fear of Russian scientific achievements and the constant spur of critics, our schools are presently upgrading themselves scholastically, more in some communities than in others and nowhere nearly enough.

Mr. FORD. Just as a matter of curiosity and not for any other reason, where did you get your primary and secondary education?

Admiral RICKOVER. I got my primary and secondary education in Chicago, sir.

Mr. CANNON. Mr. Michel of Illinois.

A NATIONAL EXAMINATION

Mr. MICHEL. Admiral, you recommended a permissive examination.

Admiral RICKOVER. Yes, sir.

Mr. MICHEL. I certainly would not want to see the Office of Education conceiving this examination.

Admiral RICKOVER. Neither would I, sir.

Mr. MICHEL. Who in your judgment would draw up this kind of approach?

Admiral RICKOVER. I think there should be a small group of people, perhaps 6 or 7, with no more than about 10 clerks. I would limit it by law, not more people than say there are in this room. Congress could set it up to advise it on these matters.

Mr. MICHEL. Would these be educators?

Admiral RICKOVER. They should be eminent people, sir. You would probably have to get them from universities. In setting standards, they ought to take into account what is being achieved abroad.

THE RESPONSIBILITY OF THE CONGRESS TO LEAD IN ACHIEVING "THE ONE INDISPENSABLE THING"

Mr. CANNON. By way of summary, Admiral Rickover, may I ask, do you feel that while some communities have taken steps to raise scholastic levels, the rate of progress is too slow? What practical means do you think Congress could take to speed up school reform?

We in the committee are aware that, as Aristotle said, "Nobody could doubt that the chief concern of the lawgiver must be the education of the young." What specific action do you suggest that this committee or the Congress can take to aid in correcting the deficiencies which you see in our educational system?

Admiral RICKOVER. Mr. Chairman, I know from the many times I have appeared before this and other committees of Congress how deeply concerned Members of Congress are about the education of our children. Over the years, in the many private discussions I have been privileged to have with individual members, I have also felt their concern. I feel that no real and timely improvement will be made unless *you* take the lead and show the way. You are the highest and most representative organ in the United States for getting things done and you have the power of the purse to make your deliberations effective. Congress has rightly been called the "potent and omnipresent teacher."

All great philosophers have understood that the education of youth is the primary function of society—the means by which humanity's inheritance is transmitted from one generation to another. When one reflects on the matter he must see that each one of us is heir to all of the ideas and accomplishments of every human being who has ever lived. This is why education is so important, why it is our responsibility as human beings to assure that our own heirs receive their full human inheritance.

Further, as Plato said—

> most issues exercising the lawgiver can be settled only by reference to the basic problem of the citizen's education.

If we adult Americans are not intelligent enough to figure out a way to improve American education, we cannot hope that our children will be intelligent enough to keep our Nation strong and prosperous and capable of living up to its task of leading the free world.

I do not wish to deprecate the importance of high moral standards, of good character, of kindliness, of humaneness, of ability to get along well with fellow citizens—there are innumerable virtues I should like to see inculcated in American youth. But the one thing which I believe will be of the greatest importance for the future of our Nation and of the free world, the one *indispensable* thing, is to bring all our children to markedly higher intellectual levels. Most of the problems they will have to cope with as individuals and as citizens of this great democracy will involve use of their minds. Whitehead wrote half a century ago that "in the modern complex social organism, the adventure of life cannot be disjoined from intellectual adventure."

To pull their weight as democratic citizens with rights, but also with civic responsibilities, our young people must be brought intellectually to a point where they can understand complex national issues, evaluate the various positions taken on these issues by individuals and organizations and judge whether their positions are based on sincere conviction or on naked self-interest; they must learn the difficult art of collectively choosing the best course of action that is feasible and do this for many diverse national issues. In all this the mind is the most important factor.

In fact, civilization has reached the point where the frontier now lies in the mind itself. Americans must conquer knowledge as formerly they conquered the wilderness. Bacon's saying, "the mind is the man" is now literally true for each man and for all of mankind. Our future depends squarely on how well we succeed in developing the minds of our young men and women. We must not, we cannot permit anything to stand in the way.

I think we must be realistic and face the fact that most people do not like very much to work with their minds; this is something we must try to teach children at school; we must get them into the habit of using their minds whenever a problem requires application of reason and logic. It is this very practical necessity that makes me insist on the importance of establishing national scholastic standards, for academic excellence does not just happen. It must be actively promoted and nothing will do this better than setting children standards and rewarding them—with class promotion, good marks, diplomas, et cetera—if they work hard and thus succeed in meeting the standards.

SPECIFIC ASPECTS OF THE ENGLISH SYSTEM FROM WHICH WE CAN LEARN

You know the Greeks in classical times were convinced they were superior to every other nation. Herodotus is said to have been the first Greek who had the temerity to suggest they might learn something from another people. He wrote his history from that point of view. I imagine this made him a "controversial person." I do feel that there are things we can learn from English education. I would include the following:

1. Elimination of "ability to pay" from public education; retention of "ability to learn"; separate secondary schools.
2. Highly qualified teachers to whom much freedom is given in their work and whose influence on all aspects of education is great, notably in setting scholastic standards through national examinations. Total absence of nonteaching school principals and administrators.
3. The use of Government grants as a means of raising national standards in education, by making acceptance of standards and of inspection to check on standards a condition for awarding grants.
4. National examinations leading to national diplomas, designed to permit great variety in selection of test subjects, yet clear-cut indication on the diploma of the type of examination taken and passed. Cooperation of all interested parties in setting up the examinations and great care in evaluating them.

These are the principal features of English education by means of which they maintain high standards while permitting decentralized management of public education. I take it these are also our own objectives. One or more of the above measures may prove acceptable to us; this is why I list them here.

FEDERAL ASSISTANCE TO EDUCATION INDISPENSABLE

Now as to what specific action this committee or the Congress could take to aid in correcting deficiencies in American education, I should like first to say that I believe such aid has now become indispensable. A number of problems are at this moment coming to a point where local, State, or private efforts no longer are able to cope with them. Recently a bill was passed greatly enlarging the scope of Federal aid to States and localities in dealing with pollution of our waterways. Testimony brought out that we must now use our water supplies over and over again, and that for this reason preservation of the quality of these water supplies has become a matter of vital national importance.

Clean water is now such an indispensable necessity that we have found a way to bring Federal aid to bear upon the pollution problem. I believe American education so clearly requires improvement that we must find a way to bring Federal aid to bear upon the education problem. For many years there have been hearings before Congress where this matter has been endlessly discussed. I suggest that Congress make a start; the problem is admittedly so complex that it will take a long time and much effort to solve it. But the important thing is to make a beginning, to tackle one item and try to solve it, so that we can then go on to another.

RECOMMENDATIONS FOR CONGRESSIONAL ACTION

I suggest that the Congress try to do two things: obtain accurate information on how we stand educationally; to what degree our educational system serves our urgent needs and how it compares with educational systems in other leading nations. And second, that the Congress set up machinery for establishment of permissive national scholastic standards through examinations. These are I believe the two most urgent measures that need to be taken; they are measures that clearly will not be taken at all unless the Congress takes the lead.

To carry out these two tasks, I suggest that a small committee of eminent, trustworthy, intelligent, and broadly educated men be set up, something on the order of the English University Grants Committee, or of our own General Accounting Office. The important thing is to keep it a small committee but one composed of truly outstanding men. Not more than six or so; and give them a very small staff. They can call on other Government agencies for help.

It would be their task to keep American education under close scrutiny. To observe how it responds to our own educational needs and how it compares with education systems in other nations. This group of men would be expected also to devise a system of examinations to be taken voluntarily but to carry Federal accreditation: preferably at different scholastic levels, and both at the transfer from high school to college, and from college to graduate department or professional school; also for teacher accreditation.

It might be advisable to entrust to this small group the working out of a good system for awarding Federal scholarships. We shall have to come to that. Professionals are being educated free of charge in more and more other democracies and, of course, in the totalitarian countries. Higher education has become so expensive that not even middle-class parents can now pay for it, still less the mass of our less affluent citizens. Unless we make up our minds to pay the cost of the long education required of professionals, we shall continue to have serious shortages. The awarding of scholarships could be made conditional on successfully passing the committee's national examinations or on having received committee accreditation.

I suggest that in assessing the state of American education the committee be requested to confine itself to scholastic attainments. We will not win the cold war, nor meet economic competition from the Common Market countries, nor obtain urgently needed skilled workers, technicians, and professionals by having swimming pools or school dances or even delightfully poised young people. It is in academic excellence that our schools must be brought to a point where the education they offer is—at every ability level—at least equivalent and preferably better than in any other country. No extraneous considerations ought to intrude when it comes to determining what is or what should be the technical task our schools must accomplish.

Because it lends itself to examination at different scholastic levels, I recommend the English GCE as a model which we might like to adapt to our own needs. I am firmly convinced that in a country where children, where everyone is "status conscious," the raising of scholastic levels in the public schools will most effectively be brought about by starting from the top. Once you have the college-preparatory high school students aiming at a nationally set standard, it will not be too difficult to get those with somewhat less academic ambitions to want a similar national goal to work for. This is exactly what is happening in England. First the GCE was a Grammar School examination. Then a few Secondary Modern School students attempted to obtain some GCE passes; then more took the exams each year. This led employers and professional bodies, as well as technical schools, to require that applicants have several GCE passes. At the moment another exam, very like the GCE but academically slightly lower, is being developed. The same spiraling of educational objective would, I feel sure, happen here.

Any examinations so established would, to my mind, have to aim at least as high scholastically as do similar examinations abroad. The criterion is not that every child should be able to meet the examination standards but that there be several levels at which children may be tested. If we wished to do as well as England currently does, we should have to have 1 million students take a GCE-type examination each year. I do not know how many English students take the exams at each of the three levels, but this could easily be ascertained. Most of them would be at ordinary level. We should also have a national examination comparable to the Secondary Modern School exam now being developed in England which could be taken by high school graduates who do not enter college. I believe such national examinations would contribute greatly to a rapid raising of scholastic standards for all types of ability levels.

A committee to set standards, to keep watch over the state of American education, to point out peril points, and to keep us fully informed on our competitive position in education—this is what I suggest would aid in correcting the deficiencies in our school system.

Mr. CANNON. Thank you, Admiral.

Admiral RICKOVER. May I ask one thing, sir?

Mr. CANNON. If you will, Admiral Rickover.

Admiral RICKOVER. I would like the permission of this committee when I put in these enclosures, since some of them are examination questions, that instead of being printed in small type, it be done so they can easily be read.

Mr. CANNON. That will be done. You may supplement your remarks when your transcript comes to you and you may include such other reference matter as you consider pertinent. We would like to have a full reply to every question.

Mr. ALFORD. Admiral Rickover, I wish to correct an impression that may have been erroneous. As I said, the only reason that I brought up the story that I had heard relative to the Mayo brothers, I wanted to make the point that in setting up examination standards that would strike across the Nation, whatever field it is in education, would we be drawing the line too severely and would your system of examination or standards that we are setting cut out some boy or girl forever, for example, of ever having an opportunity?

Admiral RICKOVER. No, sir. I mentioned the experience in the city of Manchester, where they found that out of 10,000 students there were mistakes in only 1½ percent but even those were ultimately corrected. The examination system I propose would of course be permissive.

Mr. ALFORD. I want the record to show that I am for high standards.

Admiral RICKOVER. I am not for reducing anyone's opportunity for a good education.

Mr. CANNON. Mr. Flynt of Georgia.

FREE EDUCATION IN EUROPE

Mr. FLYNT. At one time in your remarks you referred to the fact that in Russia all higher education was free.

Admiral RICKOVER. Yes, sir.

Mr. FLYNT. And that in England 80 percent of it is free.

Admiral RICKOVER. Eighty percent of English university students are on scholarship; primary and secondary education is available at no cost.

Mr. FLYNT. And either by direction or indirection you implied that in the United States it had to be paid for.

Admiral RICKOVER. Some of it does, sir.

Mr. FLYNT. I would like to make the observation that there is no such thing as anything being free. It has got to be paid for by somebody and it has to be worked for if it is to be of any value.

Admiral RICKOVER. Yes, sir. The point is this, in Russia all education is free. On the Continent practically all education is free. In England it is free except for about 20 percent of students in the universities. Certainly somebody has to pay for it. It means in England and on the Continent a consensus has been reached that the cost of education should be socialized. They have reached consensus that no one should be barred from education by lack of money.

Mr. WILSON. The old Chinese proverb, "Cut your own wood and it will warm you twice" is just as good today as ever. It is the same with the student. You cannot give him an education. He needs to work for it. I am one who feels we have done too much in giving them an education.

Mr. CANNON. Gentlemen, we have run far beyond our allotted time. Thank you, Admiral Rickover.

Admiral RICKOVER. Mr. Chairman, may I again thank you and members of the committee for the privilege of appearing before you.

Mr. CANNON. Without objection, the committee stands adjourned.

ANNEXES FOR TESTIMONY

1. Samples English General Certificate of Education (GCE) "ordinary," "advanced," and "scholarship" level examinations.

2. Samples of classroom work and test papers in Fourth Form of Secondary Modern School, Manchester, England, by pupils in slightly above average, average, and bottom ability "streams" of the school.

3. Article by Theodore Guerin, "Is This American Education?", *Ladies' Home Journal*, February 1959.

4. Samples of test work in composition as shown in Talent Survey of half a million American high school students, reprinted from *Chemical and Engineering News*, November 21, 1960.

5. Samples of compositions by American elementary and secondary school teachers taking an English refresher course at a Midwestern University, "Can Our Teachers Read and Write?", by James D. Koerner, *Harper's Magazine*, November 1954.

6. Sample English "11 plus" examination, *British Information Services*, July 1961.

ANNEX 1

GENERAL CERTIFICATE OF EDUCATION (GCE) EXAMINATIONS

While a few of the brightest Secondary Modern School pupils succeed in obtaining one to three passes of the GCE "ordinary" level, this examination is designed for Grammar and Technical School students. For the scholastic attainments of Secondary Modern School children consult Annex 2.

The GCE "ordinary" level examination is taken at the end of the fifth form (eleventh school year) at age 15–16; in rare cases at age 14. The "advanced" and "scholarship" level examinations are taken at age 18, at the end of two, occasionally three, years in the sixth form.

Normally, a student will need, as a minimum, an IQ of 110 to obtain one or more "ordinary" passes. About 30 percent of the 15–16 age group have the required intelligence, though not all of this 30 percent obtain such passes. For the "advanced" and "scholarship" level GCE a minimum IQ of 120–125 is ordinarily needed. About 10 percent of the 18-year olds have the required intelligence and again not all of these obtain advanced or scholarship passes.

SAMPLE 1

General Certificate of Education (GCE) Examination Papers "Ordinary" (O) Level

Set by University of Manchester examining body for geography, history and Latin; by Oxford University examining body for French; by Cambridge University examining body for English literature.

Age: 15–16.

GEOGRAPHY

(Marks: Each question, 20.)

TWO AND A HALF HOURS

Answer (a) Question 1 and ONE other question from Section 1, (b) THREE questions from Sections 2 and 3, including at least ONE from each of these sections.

Section 1.

You are advised to spend not more than half an hour on question 1.

1. Study the Ordnance Survey map provided (*part of Sheet SD* (1:25,000), *the grid references of the corners being* 860700, 040700, 040560, 860560).

(*a*) Describe the coastal features of the Nith estuary at low tide.

(*b*) Describe the most direct route for a walker from Nether Glensone (917595) to Congeith (871660). Estimate the distance covered and the altitude of the highest point.

(*c*) (i) Draw a sketch-map to show why roads meet at New Abbey (964663). (ii) Suggest further reasons for the growth of a settlement there.

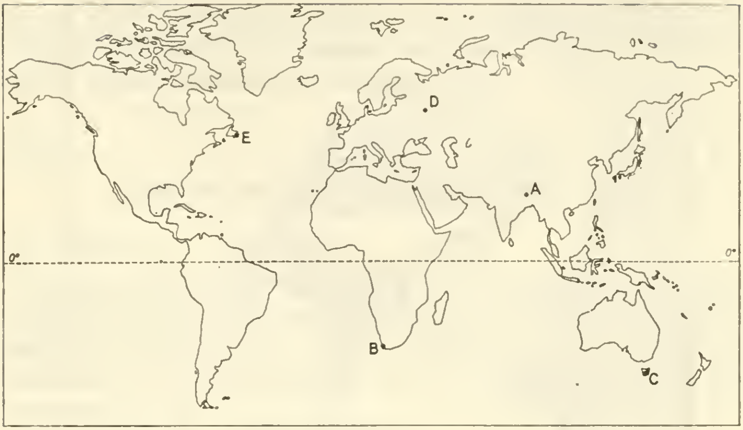
(*d*) (i) Draw a section to show if the river Nith is visible to an observer looking east from Meikle Hard Hill (935627). (ii) Without drawing a section, explain if any part of Shambellie Wood (north of New Abbey) is likely to be visible from Abbey Fell (940615).

2. (*a*) On the map (i) insert and name the tropic of Cancer and parallel 40°S.; (ii) indicate by arrows the direction over the Pacific Ocean of the prevailing winds (1) south of 40°S., (2) between the tropic of Cancer and the equator; (iii) indicate by arrows the direction of two cold (C) and two warm (W) Atlantic Ocean currents; (iv) shade an area of scanty rain bordering the South Atlantic and an area of abundant rain bordering the North Pacific.

(*b*) A, B, C, D, E are stations marked on the map.

Rainfall (inches)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
A ..	0·8	1·1	2·0	4·1	7·8	24·2	31·7	26·0	18·3	5·3	0·2	0·2
B ..	0·7	0·6	0·9	1·8	3·9	4·4	3·5	3·3	2·2	1·6	1·1	0·8
C ..	1·8	1·5	1·6	1·8	1·9	2·2	2·1	1·8	2·1	2·2	2·5	1·9



(i) Account for the difference at A between the total rainfall in summer and in winter. (ii) Name the season of maximum rain at B and state why rainfall is abundant then. (iii) Explain why rain falls in all seasons at C.

(*c*) Why is winter very cold at (i) D, (ii) E?

3. Choose **three** of the following: waterfall, canyon, spring line, delta, ox-bow lake. For each, (i) state the location of a particular example; (ii) explain how such a feature has been formed, using diagrams to illustrate your answer.

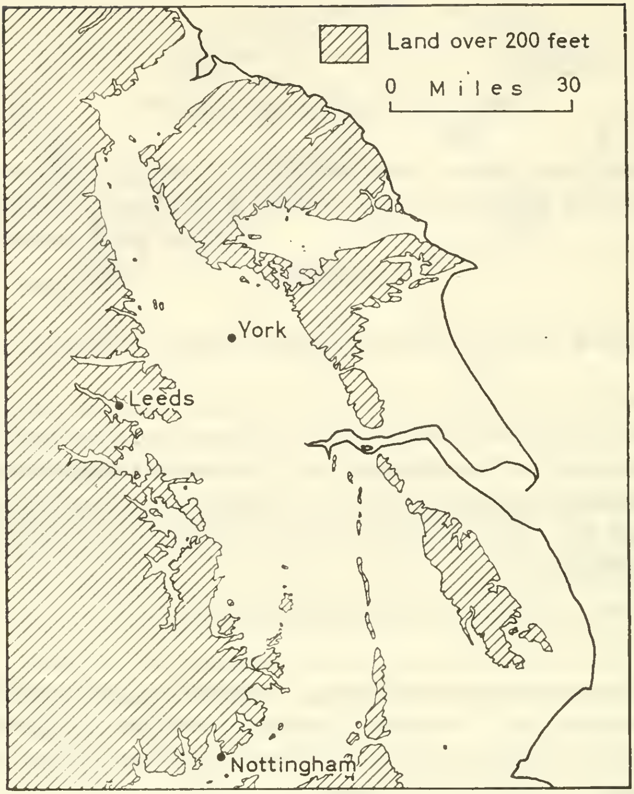
4. Choose **three** of the following industries: aluminium smelting, chemical manufacturing, shipbuilding, cotton textile manufacturing, fish canning.

For each industry chosen, (i) draw a sketch-map to show the location of an area **outside the British Isles** where it is important; (ii) state the conditions which have assisted the growth of the industry there.

Section 2.

Answer at least ONE question from this section.

5. (*a*) On the map (i) name the North York Moors, the Lincoln Wolds, Holderness, the Vale of Pickering; (ii) insert and name the rivers Aire, Ouse, Tees and Trent.



(*b*) Within the area covered by the map, locate (i) a wool textile manufacturing district, (ii) a town engaged in the heavy steel industry, in each case suggesting the reasons for the growth of the industry.

6. Describe (i) the chief features of relief and drainage, (ii) the climate, (iii) the ways in which people gain a livelihood, in **either** Northern Ireland **or** Scotland north of the Central Lowlands.

7. (*a*) Draw a sketch-map of the basin of the river Thames: (i) shade and name the Cotswold Hills, the Chiltern Hills, the North Downs; (ii) indicate and name **two** tributaries; (iii) mark by dots and name Oxford, Reading, Rochester, Tilbury.

(*b*) Describe farming activities in the basin, suggesting how they are influenced by geographical conditions.

(*c*) Suggest reasons for the importance of **either** Oxford **or** Reading.

8. Choose **three** of the following cities: Bristol, Cardiff, Dublin, Dundee, Stoke-on-Trent. For each city chosen, (i) draw a sketch-

map to show its location; (ii) name **one** manufacturing industry for which it is important and suggest the factors which have aided the growth of the industry in that locality.

Section 3.

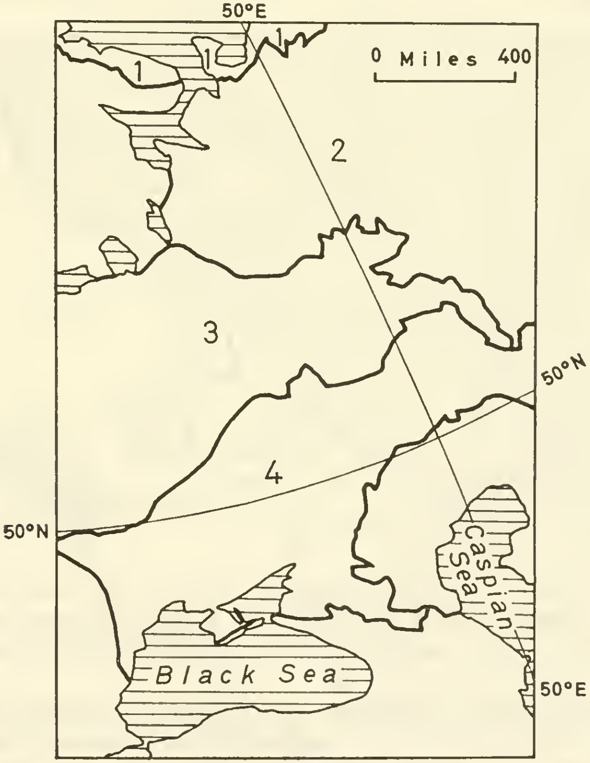
Answer at least ONE question from this section.

9. (*Europe.*)

Give an account of **either** Belgium **or** Denmark **or** Switzerland; emphasise (i) the main features of relief and drainage, using a sketch-map in illustration, (ii) the chief farming activities, (iii) manufacturing industries and the geographical factors which have favoured their development.

10. (*Europe.*)

The map shows a division of Russia in Europe into regions of natural vegetation.



(*a*) On the map (i) name the natural vegetation of the four regions numbered; (ii) shade the Ural Mountains and insert and name the rivers Don and Volga; (iii) mark by dots and name Archangel, Leningrad, Odessa.

(*b*) Suggest which of the regions numbered on the map is of the greatest agricultural value to Russia and which the least. In each case give reasons for your choice.

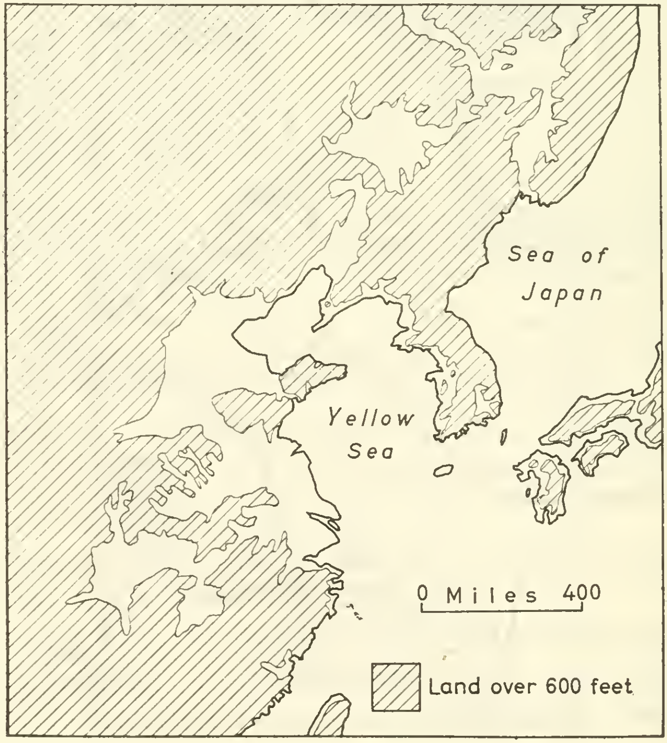
11. (*North America.*)

Give an account of **either** the Prairie Provinces of Canada **or** New England, emphasising the principal features of the natural landscape, climatic characteristics and chief industries.

12. (*South America.*)

North Chile, Middle Chile and South Chile differ in climate and economic resources. Describe each region so as to illustrate these differences.

13. (*Asia.*)



(*a*) On the map (page 41) (i) insert and name the Hwang ho and Yang tse kiang; (ii) mark by dots and name Peking, Shanghai, Vladivostok; (iii) mark Korea (K) and Manchuria (M).

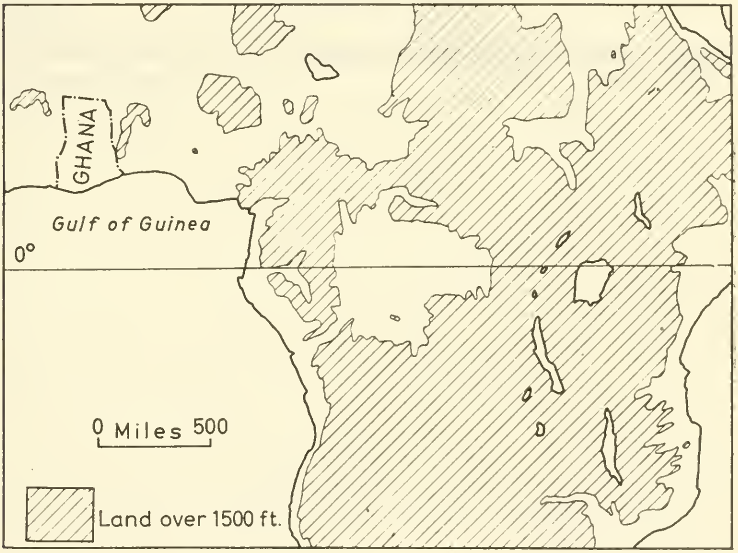
(*b*) Write an account of the physical features of the Hwang ho basin.

(*c*) Describe the climate of the North China Plain, giving reasons for the conditions you note.

(*d*) Suggest reasons for the high density of population on the lowlands of China.

14. (*Africa.*)

(*a*) On the map (i) name **three** lakes; (ii) insert and name the rivers Congo and Niger; (iii) indicate the rift valley.



(*b*) (i) Describe the agricultural and mineral resources of the Belgian Congo. (ii) Show how the development of these resources has been retarded by geographical conditions.

(*c*) Describe the climate of Ghana (Gold Coast) and name the cultivated products which it favours.

15. (*Australasia.*)

Describe the geographical conditions under which each of the following is produced.

(*a*) Beef in the Northern Territory of Australia.
(*b*) Butter on the coastal lands of New South Wales.
(*c*) Mutton in South Island, New Zealand.

HISTORY

Syllabus I

ENGLISH AND EUROPEAN HISTORY

(Marks: Each question, 20; Style and Presentation, 11.)

TWO AND A HALF HOURS

Candidates are advised to pay attention to legibility, clarity and conciseness of expression, the correct use of punctuation and the avoidance of abbreviations and slang expressions.

Answer FIVE questions.

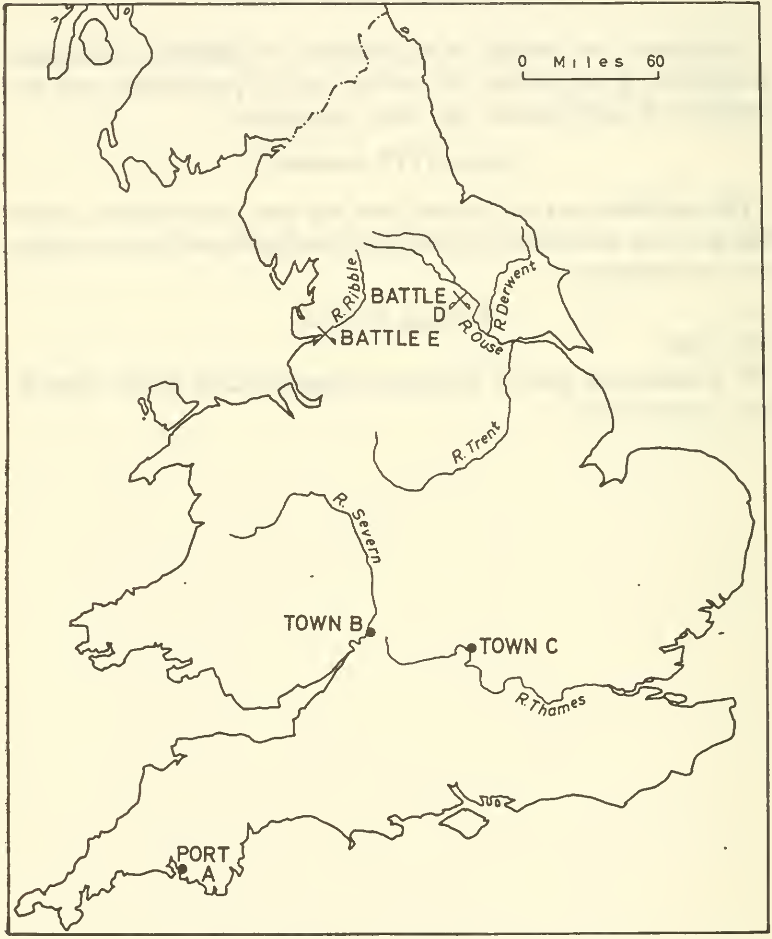
The questions may be chosen from any part of the paper except that not more than **one** *of the map questions (indicated by an asterisk) may be attempted.*

ENGLISH HISTORY

1485—1660

***1.** Examine the map of England during the Civil Wars; then in your answer-book (*a*) (i) name Port A, (ii) state why Port A was important, (iii) name Town B, (iv) name the Parliamentary leader who raised the siege of Town B, (v) name Town C, (vi) state why Town C was important, (vii) name Battle D, (viii) state one result of Battle D, (ix) name Battle E, (x) name the general who was victorious at Battle E.

(*b*) Explain why Parliament won the first Civil War.



2. By what means did Henry VII secure his position on the throne?

3. Describe Wolsey's policy at home and abroad.

4. Explain why Mary Tudor was (*a*) popular when she came to the throne but (*b*) unpopular at the end of her reign.

5. Explain why there was economic distress in England in the middle of the sixteenth century. How did Elizabeth I's government deal with it?

6. Describe the relations between England and Spain in the reign of Elizabeth I up to the defeat of the Armada.

7. What were the chief matters in dispute between James I and his Parliaments?

8. Describe the work of the Long Parliament until the outbreak of the Civil War.

9. What were the achievements of Oliver Cromwell as a soldier?

10. Give a brief account of any **four** of the following: (*a*) the Battle of Flodden; (*b*) the navy of Henry VIII; (*c*) Lady Jane Grey; (*d*) the Act of Supremacy, 1559; (*e*) the Hampton Court Conference; (*f*) Strafford's work in Ireland; (*g*) the Navigation Act, 1651; (*h*) the Instrument of Government.

1660—1783

11. Select any **five** of the following. Describe their geographical position and explain briefly their importance in this period. (*a*) Fort Duquesne, (*b*) Louisburg, (*c*) Quebec, (*d*) Montreal, (*e*) Minorca, (*f*) Arcot, (*g*) Plassey, (*h*) Bombay, (*j*) Madras, (*k*) Martinique.

12. Give an account of the careers and achievements of **two** of the following: (*a*) Clarendon; (*b*) Danby; (*c*) Shaftesbury.

13. Describe the events of James II's reign which led to the Revolution of 1688.

14. What difficulties did William III have to overcome before he was securely established on the throne?

15. Explain why England became involved in the War of Spanish Succession and state what she gained as a result of this war.

16. Explain why Walpole was successful during his period of office between 1721 and 1742.

17. Describe John Wesley's work and explain its importance.

18. What were the main causes and results of the enclosure of open fields in the eighteenth century?

19. On what issues did the British government and the American colonists differ during the period 1763 to 1775?

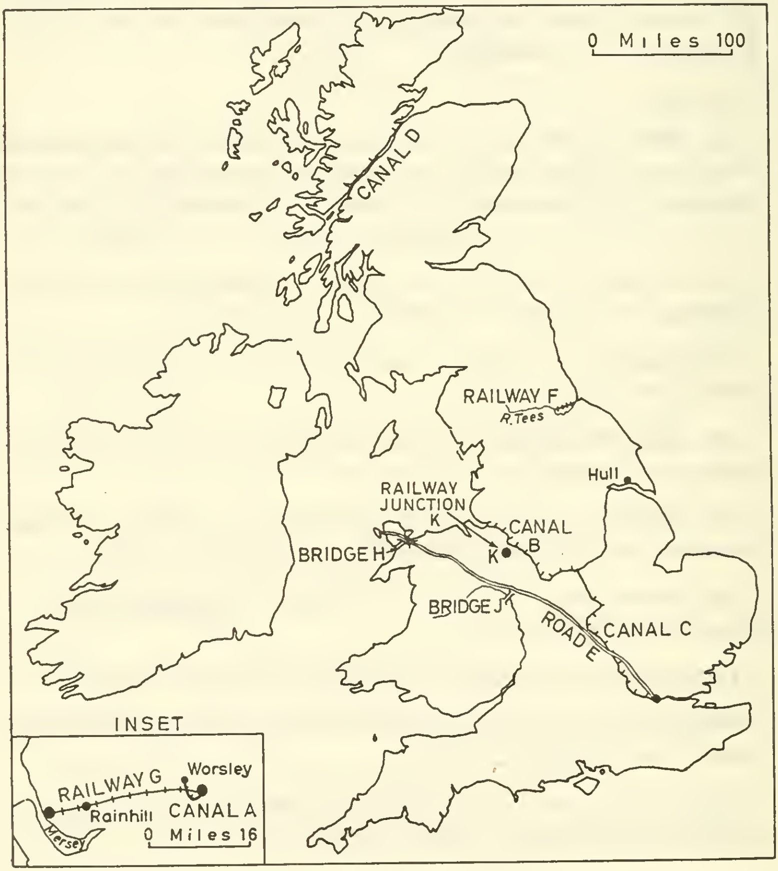
20. Write short accounts of any **four** of the following: (*a*) the Great Fire of London; (*b*) John Bunyan; (*c*) the Darien scheme; (*d*) Daniel Defoe; (*e*) Thomas Newcomen; (*f*) James Watt; (*g*) John Wilkinson; (*h*) the charges against Warren Hastings at his trial.

1783—1867

***21.** Examine the map of Britain and the inset illustrating transport developments in the late eighteenth and early nineteenth centuries; then in your answer-book

(*a*) name (i) Canal A, (ii) Canal B, (iii) Canal C, (iv) Canal D, (v) Road E, (vi) Railway F, (vii) Railway G, (viii) Bridge H, (ix) Bridge J, (x) Railway Junction K.

(*b*) Write a short account of the achievements of Telford and Macadam.



22. Describe briefly the Younger Pitt's domestic policy (*a*) before 1793, (*b*) after 1793.

23. What part did the British army play in securing the defeat of Napoleon?

24. Write a short account of the reforms introduced by Huskisson and Peel between 1822 and 1830.

25. Examine the achievements in India of **two** of the following: (*a*) Wellesley, (*b*) Bentinck, (*c*) Dalhousie.

26. Write a short account of the domestic achievements of Peel's ministry of 1841–46.

27. Discuss the foreign policy of Palmerston as Foreign Secretary.

28. Write a short account of the part played by Britain in the Crimean War. Is it fair to say that the results of the war were " trifling and temporary "?

29. Trace the development of Canada from 1783 to the establishment of the Dominion in 1867.

30. State the main facts concerning any **four** of the following: (*a*) William Wilberforce; (*b*) Edwin Chadwick; (*c*) Feargus O'Connor; (*d*) the Prince Consort; (*e*) " Clemency Canning "; (*f*) Charles Darwin; (*g*) Robert Lowe; (*h*) Lord Macaulay.

1867—1939

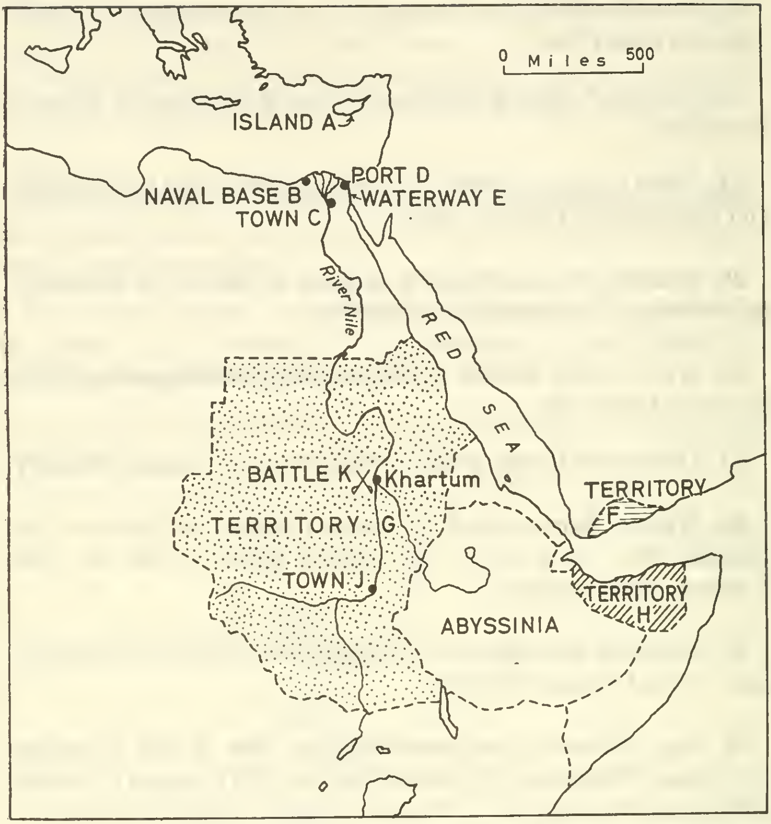
***31.** Examine the map of North East Africa (page 29); then in your answer book

(*a*) name (i) Island A, (ii) Naval Base B, (iii) Town C, (iv) Port D, (v) Waterway E, (vi) Territory F, (vii) Territory G, (viii) Territory H, (ix) Town J, (x) Battle K.

(*b*) Write a short account of Cromer's work in Egypt.

32. By what means and with what success did Gladstone try to pacify Ireland?

33. Describe the reforms of Gladstone and Disraeli between 1867 and 1885 under **two** of the following headings: (*a*) education, (*b*) trade unions, (*c*) parliamentary reform.



34. What part did Britain play in the " scramble for Africa " in the last quarter of the nineteenth century?

35. Explain how and why relations between Britain and the following countries improved from 1901 to 1914: (*a*) Japan, (*b*) France, (*c*) Russia.

36. Describe briefly any **three** of the following: (*a*) the Battle of the Marne, 1914; (*b*) the operations in Gallipoli; (*c*) the Battle of Jutland, 1916; (*d*) the German offensive on the Western front in 1918.

37. Write an account of Gandhi's career and achievements.

38. What social and economic reforms were made in Britain between the two World Wars?

39. Give a short account of the relations between Britain and Germany from Hitler's accession to power in 1933 to the outbreak of war in 1939.

40. State the main facts concerning any **four** of the following: (*a*) the Fourth Party; (*b*) the Manchester Ship Canal; (*c*) the General Election of 1906; (*d*) the two General Elections of 1910; (*e*) the Irish Home Rule Bill of 1914; (*f*) the Easter Rebellion in Ireland, 1916; (*g*) the General Strike; (*h*) the first Labour Government.

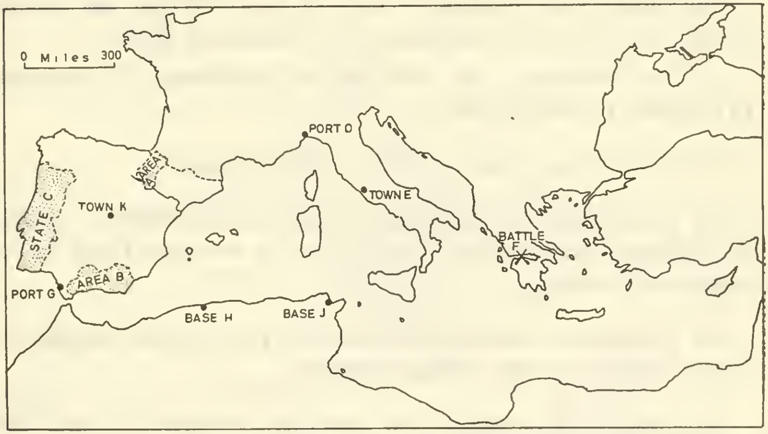
EUROPEAN HISTORY

1494—1660

***41.** Examine the map of the Mediterranean in the fifteenth and sixteenth centuries; then in your answer-book

(*a*) name (i) Area A, (ii) the King who conquered Area B, (iii) the Spanish King who acquired State C, (iv) the explorer who was born in D, (v) the Holy Roman Emperor who sacked Town E, (vi) sea battle F, (vii) Port G, (viii) Turkish base H, (ix) Turkish base J, (x) Town K.

(*b*) Describe the difficulties of the Emperor Charles V in the Mediterranean area.



42. Describe the part played in the Italian Wars by (*a*) Charles VIII, (*b*) Ferdinand of Aragon.

43. Outline the career and achievements of Martin Luther.

44. Describe the steps taken by the Church of Rome in the sixteenth century to meet the challenge of the Protestants to its authority.

45. What were the causes and results of the revolt of the Netherlands?

46. (*a*) What were the causes of the religious wars in France in the latter part of the sixteenth century? (*b*) Show how Henry IV restored royal power in France.

47. Give an account of the part played by Sweden in the Thirty Years War.

48. Indicate the main provisions of the Treaty of Westphalia and estimate their importance.

49. Describe the struggle between France and Spain from the Treaty of Westphalia to the Treaty of the Pyrenees.

50. Write brief accounts of any **four** of the following: (*a*) Leonardo da Vinci; (*b*) Pizarro; (*c*) Caesar Borgia; (*d*) Louis XII of France; (*e*) Don John of Austria; (*f*) Ferdinand II (Holy Roman Emperor); (*g*) Christina, Queen of Sweden; (*h*) Turenne.

1660—1789

51. Describe the position of each of the following and explain briefly why they were important in the eighteenth century:

(*a*) St. Petersburg, (*b*) the Barrier Fortresses, (*c*) Antwerp, (*d*) Bavaria, (*e*) the Crimea.

52. Discuss the value of Colbert's work in France.

53. Explain how the weakness of the Spanish monarchy affected the relations between the Great Powers in the second half of the seventeenth century.

54. Describe the decline of Sweden as a Great Power between the Treaty of Oliva and the Treaty of Nystadt.

55. Describe the attempts that were made between 1715 and 1740 to upset the peace settlement of Utrecht and explain why they failed.

56. Give an account of the domestic policy of Frederick the Great.

57. Indicate the main provisions of the treaties of Paris and Hubertsburg, 1763, and estimate their importance.

58. Why is Joseph II regarded as an enlightened despot?

59. What were the causes which brought about the three Partitions of Poland?

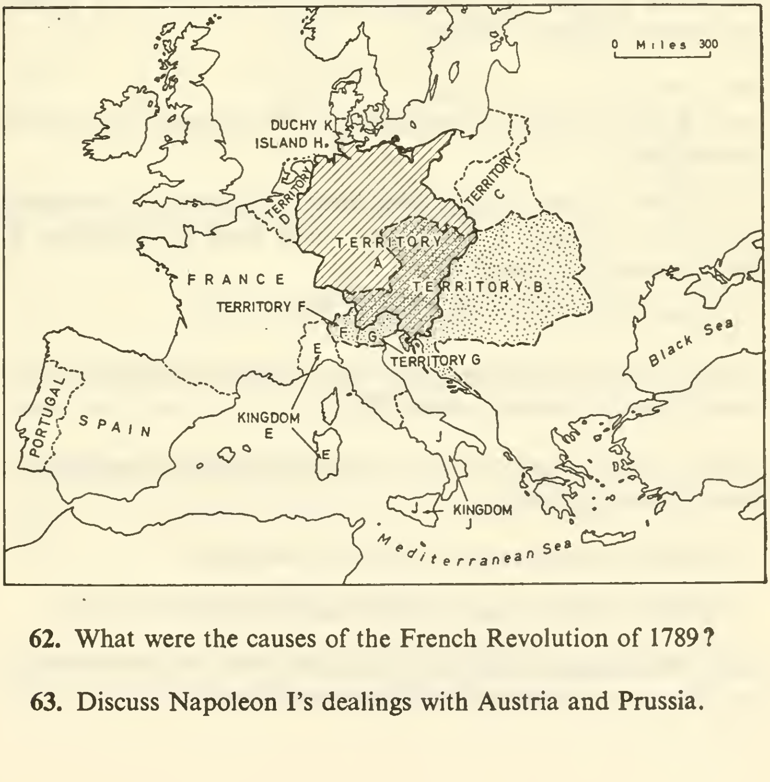
60. Explain the importance of any **four** of the following: (*a*) the Revocation of the Edict of Nantes; (*b*) the rule of Charles XI in Sweden; (*c*) the War of the Polish Succession; (*d*) the Treaty of Aix-la-Chapelle, 1748; (*e*) the death of Elizabeth I of Russia; (*f*) the writings of Voltaire; (*g*) French participation in the American War of Independence; (*h*) the meeting of the States General, 1789.

1789—1870

***61.** Examine the map of Europe after the Congress of Vienna, 1815; then in your answer-book

(*a*) name (i) shaded Territory A, (ii) Territory B, (iii) Territory C, (iv) Territory D, (v) Kingdom E, (vi) Territory F, (vii) Territory G, (viii) Island H, (ix) Kingdom J, (x) Duchy K.

(*b*) What changes were made on France's frontiers in 1815 to strengthen neighbouring countries?



62. What were the causes of the French Revolution of 1789?

63. Discuss Napoleon I's dealings with Austria and Prussia.

64. Write an account of the reigns of Louis XVIII and Charles X of France.

65. Explain how the Greeks secured their independence.

66. Describe the main events of the revolutions of 1848–9 in (*a*) Hungary, and (*b*) Italy, and explain why those who rose in revolt failed to achieve their aims.

67. Show how Bismarck brought about the unification of Germany.

68. Describe the part played by Louis Napoleon (as President and Emperor) in Italian affairs.

69. Outline the domestic and foreign policies of Alexander II of Russia to 1870.

70. Write short accounts of any **four** of the following: (*a*) the Directory; (*b*) the Consulate; (*c*) the Congress of Aix-la-Chapelle; (*d*) the Carlsbad Decrees; (*e*) the Sonderbund; (*f*) the national workshops in Paris; (*g*) Garibaldi's conquest of Sicily and Naples; (*h*) Adolphe Thiers (to 1870).

1870—1939

***71.** Examine the map of the Balkans in 1913 (page34) ; then in your answer-book

(*a*) name (i) State A, (ii) shaded area B, (iii) State C, (iv) shaded area D, (v) Territory E, (vi) State F, (vii) State G, (viii) State H, (ix) Provinces J, (x) Island K.

(*b*) State the terms of the Treaty of Berlin, 1878.

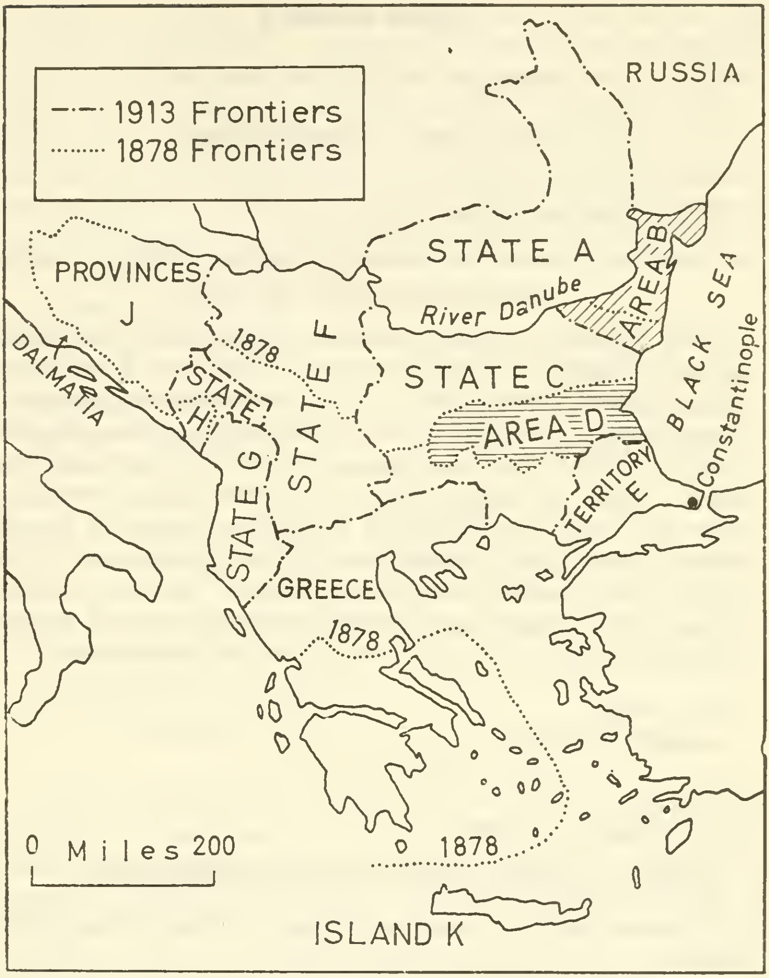
72. For what reasons and with what success did Bismarck try to secure allies for Germany after 1871?

73. To what extent had France re-established her position as a Great Power by 1904?

74. What were the causes of the first World War?

75. What were the causes of the Russian revolution of 1917?

76. What changes were made in the map of Europe as a result of the Treaties of Versailles, St. Germain and Trianon?



77. Write an account of the history between 1919 and 1939 of **either** (*a*) Poland **or** (*b*) Czecho-Slovakia.

78. Describe the organization of the League of Nations and suggest why it failed to prevent the outbreak of the second World War.

79. State the reasons for the collapse of the Weimar Republic.

80. Give a brief account of Mussolini's home and foreign policy up to the outbreak of the second World War.

LATIN PAPER I

(**Marks:** Qn. 1, 60; Qn. 2, 40; Qn. 3, 80.)

ONE AND A HALF HOURS

1. Translate into English:

At the siege of Fidenae the Romans are attacked with a new weapon, which they turn against the enemy.

Portis Fidenarum repente apertis nova acies erupit. Nam ingens multitudo, facibus ardentibus armata, ex urbe ruit Romanosque primo exterruit. Tum dictator, cum ad sinistrum cornu accurrisset, "Num fumo victi," inquit, "inermi hosti cedetis? Non ferro exstinguetis ignes? Vel si igni, non telis, pugnandum est, nonne has ipsas faces eripietis atque in hostes inferetis? Virtutis patrum vestraeque memores, vertite hoc incendium in hostium urbem, ut flammis deleatis Fidenas, quas beneficiis vestris placare non potuistis". Quo imperio ducis audito progrediuntur Romani; faces vi eripiunt; utraque acies armatur igni. Praefectus equitum renovat pugnam equestrem et ipse primus equo vectus in medios ignes infertur.

fax: torch.
inermis: unarmed.

2. Translate into Latin:

(*a*) No one is so good that he cannot become much better.

(*b*) I would not have said that, if I had thought that you were present.

(*c*) Though they all came into the wood with me, I do not know where they are now.

(*d*) Two hundred ships, of which only fifty returned home, were sent to conquer the island.

(*e*) Ought we not to love even those who try to harm us?

3. Translate into Latin:

Croesus, king of Lydia, was preparing war against a neighbouring kingdom. However, he first wished to know whether he would be victorious. So before he moved his army across the river into the enemy's country, he sent a messenger to Delphi to consult the god whose oracle was there. Asked by the messenger, the god replied, " The king will destroy a great kingdom if he crosses that river ". Croesus, delighted with this reply, at once marched against the enemy. But after a fierce battle, when his soldiers had been put to flight, the king was captured. Thus by waging war Croesus himself destroyed his own kingdom. By such examples the gods teach us that what we wish to believe is not always true.

neighbouring: *finitimus.*
Delphi: *Delphi, Delphorum.*
oracle: *oraculum.*
to delight: *delectare.*
example: *exemplum.*

LATIN PAPER II

(**Marks:** Qn. 1, 70; Qn. 2, 46; Qn. 3, 4.)

ONE AND A HALF HOURS

1. (*a*) Translate into English:

Two incidents illustrating the good-humoured clemency of King Antigonus.

Stabant quondam duo milites prope regis Antigoni tabernaculum. Dicebant ea quae homines dicere solent qui de rege suo male existimant. Audierat omnia Antigonus, cum inter dicentes et audientem palla modo interesset. Hanc ille leviter dimovit, et " Longius " inquit " discedite, ne rex vos audiat." Idem alio tempore quosdam ex militibus suis audiit imprecantes regi, quod exercitum in difficile iter et grave lutum induxisset. Accessit ad eos qui maxime laborabant et, cum eos ignorantes a quo *adiuvarentur* explicuisset, " Nunc " inquit " maledicite Antigono, cuius culpa in has miserias incidistis: ei autem bene optate qui vos ex hac palude eduxit."

palla: curtain.
imprecari (+dative): to curse.
lutum: mud.
laborare: to be in difficulties.
explicare: to free, extricate.

(*b*) State briefly the reason for the mood and tense of *adiuvarentur*.

2. Translate into English:

(*a*) Hic vasto rex Aeolus antro
luctantes ventos tempestatesque sonoras
imperio premit ac vinclis et carcere frenat.
Illi indignantes magno cum murmure montis
circum claustra fremunt; celsa sedet Aeolus arce
sceptra tenens mollitque animos et temperat iras;
7 ni faciat, maria ac terras caelumque profundum
8 quippe ferant rapidi secum verrantque per auras.

(*b*) " O regina, novam cui condere Iuppiter urbem
iustitiaque dedit gentes frenare superbas,
Troes te miseri, ventis maria omnia vecti,
oramus: prohibe infandos a navibus ignes,
parce pio generi et propius res aspice nostras.
Non nos aut ferro Libycos populare penates
venimus, aut raptas ad litora vertere praedas;
non ea vis animo nec tanta superbia victis."

3. Scan lines 7 and 8 in 2 (*a*), marking the feet and quantities, and any elisions.

O 10/I

OXFORD LOCAL EXAMINATIONS

GENERAL CERTIFICATE OF EDUCATION

Summer Examination, 1958

Ordinary Level

FRENCH, PAPER I

TUESDAY, JULY 8. TIME ALLOWED—1½ HOURS

[Write the number of the paper, O 10/I, on the left at the head of each sheet of your answers in the space provided.]

1. Translate into French:

Yesterday evening, as I was going to the beach, I found some beautiful flowers beside the path. 'Give them to me,' said my sister; 'I'll keep them while you are swimming, and when you come out of the water, I'll give them back to you.'

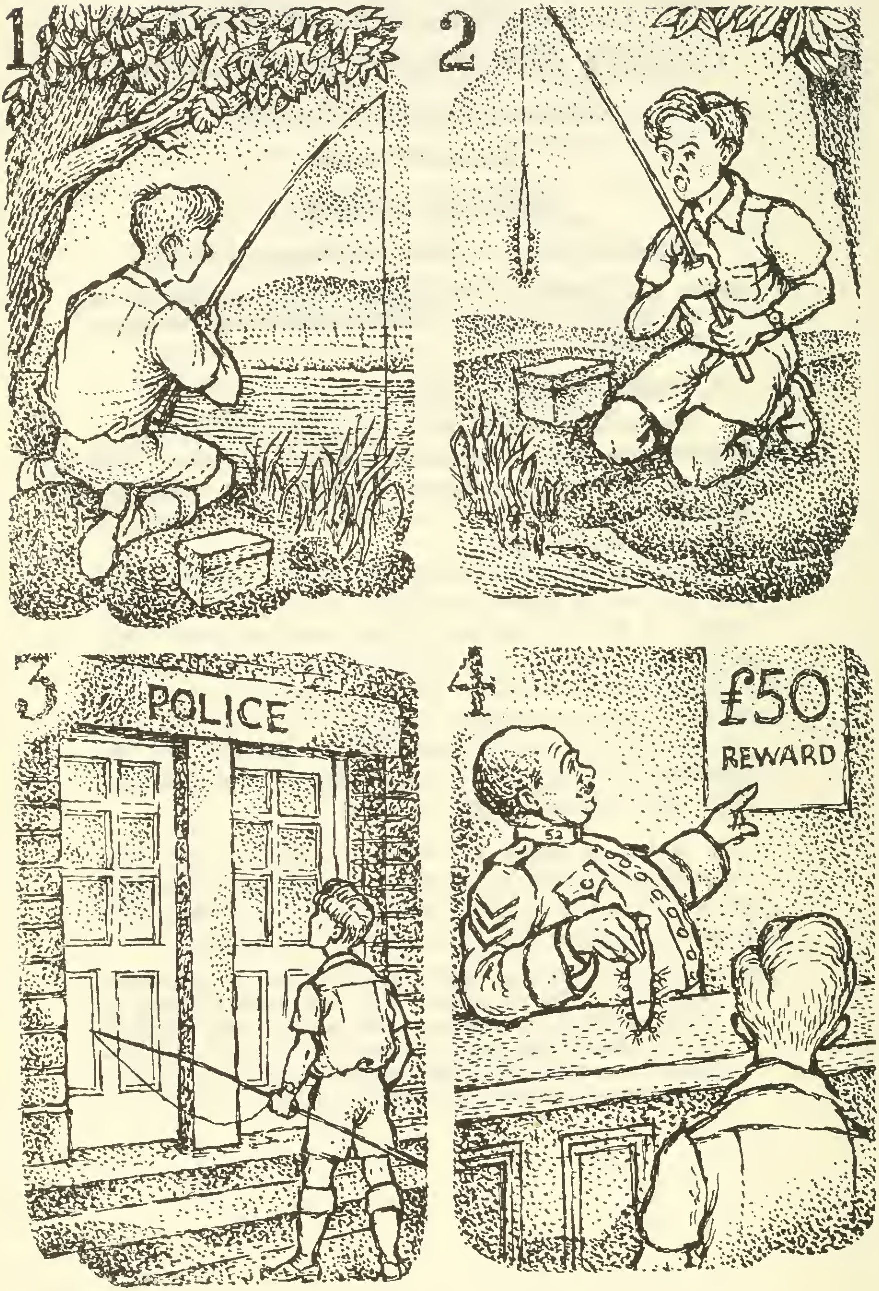
She sat down on the sand, and when I looked at her she was eating some chocolate. 'Don't eat it all!' I cried. 'I want some too.' After half an hour I was ready and asked her for my flowers and my chocolate.

But there was no more chocolate and she had lost the flowers! I was very angry. 'You should always do what you promise,' I said. Naturally she had not had the intention of vexing me. We were both unhappy and we went home without saying a word.

2. Write, in about 120 words of French, the story depicted in the sketches overleaf, including such descriptive detail as you consider relevant. State at the end of your story the number of words you have used.

[Correct your work carefully: gross errors in grammar will be heavily penalized. You will gain nothing by writing MORE than about 120 words; you will lose by writing LESS than 115 words. You are particularly warned against the introduction of irrelevant memorized matter or undue repetition.]

Le collier retrouvé
ou
La pêche (*catch*) inattendue



O 10/II

OXFORD LOCAL EXAMINATIONS

GENERAL CERTIFICATE OF EDUCATION

Summer Examination, 1958

Ordinary Level

FRENCH, PAPER II

TUESDAY, JULY 8. TIME ALLOWED—1½ HOURS

[Write the number of the paper, O 10/II, on the left at the head of each sheet of your answers in the space provided.]

1. Translate into English:

(*a*) On m'avait dit que je trouverais l'hospitalité dans la maison du Français qui habitait à deux kilomètres du village, dans un bois d'orangers. Qui était-il ? Je l'ignorais encore. Il était arrivé un matin, dix ans plus tôt; il avait acheté de la terre, planté des vignes, semé des grains; il avait travaillé avec passion. Puis, d'année en année, agrandissant son domaine, il avait amassé une fortune par son labeur infatigable.

Mais il travaillait toujours. Levé de bonne heure, parcourant ses champs jusqu'à la nuit, il semblait torturé par l'insatiable désir de l'argent, que rien n'apaise.

Le soleil baissait quand j'atteignis sa demeure. C'était une large maison carrée qui dominait la mer. Comme j'approchais, un homme à grande barbe parut à la porte. L'ayant salué, je lui demandai un logement pour la nuit. Il me tendit la main en souriant.

— Entrez, monsieur, vous êtes chez vous.

(*b*) La fin du dîner fut très gaie. Lorsque le dessert parut — du fromage et des biscuits — la grande joie fut une brusque apparition du chien, Mathieu. Jusque-là, il avait dormi quelque part, sous la table. L'arrivée des biscuits venait de l'éveiller. Tous les soirs, à ce moment précis, il se secouait, il faisait sa ronde, demandant à chacun un morceau. D'habitude, c'était Lazare qui avait le plus vite pitié de lui; seulement, ce soir-là, Mathieu regarda fixement Pauline, de ses bons yeux presque humains. Puis, devinant en elle une grande amie des bêtes, il posa sa tête énorme sur le genou de la jeune fille, sans la quitter de ses regards pleins de supplications.

— Oh! le mendiant! dit madame Chanteau. Doucement, Mathieu! veux-tu bien ne pas te jeter sur la nourriture!

Le chien, d'un seul coup, avait avalé le morceau de biscuit que Pauline lui tendait. Elle riait, le baisait, et le trouvait bien drôle.

2. Read the following passage carefully and answer the questions set on it. **The answers must be entirely in English.** No credit will be given for anything in French:

The Abominable Snowman

Depuis qu'on a supposé l'existence, sur le toit du monde, d'une race inconnue d'hommes ressemblant à des singes, capables de survivre à des altitudes très grandes et d'échapper à toutes poursuites, on a proposé bien des théories extravagantes. En voici quelques-unes:

L'Homme des Neiges ou le Yeti — c'est ainsi qu'on l'appelle au Tibet — est un survivant de l'âge des cavernes. Ou bien c'est un gorille transformé par les radiations cosmiques, qui sont très sévères à cette altitude. Ou bien c'est un visiteur d'une autre planète. Il n'est pas impossible, dit-on, que les 'Martiens' aient expédié sur terre des animaux, pour voir s'ils peuvent s'adapter à la vie sur notre globe.

Grâce à d'aussi absurdes théories, l'Homme des

Neiges est devenu un sujet de plaisanteries. Mais en 1953 une expédition fut lancée sur les traces du Yeti. La première tâche des explorateurs fut d'interroger les Sherpas, habitants du territoire de l'Everest. Les Sherpas sont les gens les moins superstitieux. Ils considèrent le Yeti comme un animal, au même titre que l'ours et le léopard des neiges. D'après les descriptions qu'ils en ont fournies, le Yeti est une espèce de gros singe sans queue, couvert de longs poils rouges. Il a la taille d'un garçon de quatorze ans. Il marche droit comme un homme, mais parfois se laisse tomber à quatre pattes. Il pousse un long miaulement, et se nourrit de rongeurs (*rodents*) qu'il nettoie soigneusement avant de les manger. Il dégage une odeur répugnante : de là un des noms qu'on lui a donnés : 'l'Abominable Homme des Neiges.'

(*a*) What theories have been put forward to explain the 'Yeti'?

(*b*) Who are the Sherpas?

(*c*) How do the Sherpas describe the Yeti's appearance?

(*d*) What do the Sherpas say of the Yeti's manner of walking?

(*d*) For what reason has he been called the 'Abominable Snowman'?

F

OF/O/Dict. Ordinary

STRICTLY CONFIDENTIAL

OXFORD LOCAL EXAMINATIONS

GENERAL CERTIFICATE OF EDUCATION

Summer Oral Examination, 1958

Ordinary Level

FRENCH PASSAGE FOR DICTATION

In order that uniformity of assessment may be attained, it is necessary that a fixed mode of procedure be followed.

The examiner must therefore:

1. **Talk to the candidates for two or three minutes in French in order to put them at their ease and to accustom them a little to his voice.**
2. **Read the passage (including the title in English) a first time at an ordinary rate, so that the candidates may catch the general import of it.**
3. **Dictate slowly in breath-groups, as indicated by the bars, allowing ample time, and repeating each breath-group once while the candidates are writing. All punctuation marks must be dictated in French.**
4. **Allow three minutes for revision and correction.**
5. **Read the passage over a last time at an ordinary rate in order to give an opportunity for a final revision.**

The candidates' scripts must then be immediately given up.

First Alternative

A lost railway ticket

L'homme monta dans le train, | trouva une place, | s'assit | et se mit à lire | son journal. | Soudain, | il s'aperçut | que le contrôleur | était devant lui. | Il chercha son billet, | ne le rencontra pas | à la place habituelle, | qui était | la poche inférieure droite | du gilet, | ni ailleurs. |

'Je l'ai mis quelque part | après l'avoir montré | à la barrière', | dit-il pour s'excuser. |

Le contrôleur | attendait toujours, | la main avancée | pour recevoir le billet. | L'homme le retrouva enfin | et le remit au contrôleur | avec un soupir | de soulagement.

This sheet must be returned to Oxford by the examiner with the last form **OF/O.**

The examiner must:

1. **Talk to the candidates for two or three minutes in French in order to put them at their ease and to accustom them a little to his voice.**
2. **Read the passage (including the title in English) a first time at an ordinary rate, so that the candidates may catch the general import of it.**
3. **Dictate slowly in breath-groups, as indicated by the bars, allowing ample time, and repeating each breath-group once while the candidates are writing. All punctuation marks must be dictated in French.**
4. **Allow three minutes for revision and correction.**
5. **Read the passage over a last time at an ordinary rate in order to give an opportunity for a final revision.**

The candidates' scripts must then be immediately given up.

Second Alternative

Getting ready to see the Queen of England

Toute la ville | était en fête. | La reine d'Angleterre | devait y passer | pendant son voyage | en France. | On avait mis | des drapeaux britanniques | et français | à la façade | de toutes les maisons | qui donnaient | sur la rue principale; | on avait accordé | un congé | de toute la journée | aux élèves, | qui étaient déjà groupés | sur les trottoirs | avec leurs instituteurs. | Monsieur le maire, | en habit de cérémonie | et portant son écharpe | tricolore, | attendait | l'arrivée de la reine | à l'entrée de la ville. | Tout était prêt.

This sheet must be returned to Oxford by the examiner with the last form **OF/O.**

F

Ordinary

OF/O/Read.

[For the use of the examiner only.]

Candidate's Centre
for written papers________________________________

Candidate's Name____________________________________

OXFORD LOCAL EXAMINATIONS

GENERAL CERTIFICATE OF EDUCATION

Summer Oral Examination, 1958

Advanced and Scholarship Level

FRENCH (READING SHEET)

	Reading	Conversation
Marks		

General Remarks

First Alternative

'Mets-toi bien dans la tête que je ne veux pas sortir cet après-midi,' dit Julien; 'il vente et il pleut; si l'on prend l'auto, il faudra la nettoyer après et je n'ai pas le temps pour cela. D'ailleurs, tu as, comme moi, du travail à faire. Mettons-nous-y, on aura la conscience nette pour sortir demain.'

'Tout ce que tu dis est très juste,' répondit Henri, 'mais tu oublies que nous avons promis à tes neveux de les emmener au cinéma; je suis sûr que tu ne voudrais pas leur manquer de parole.'

Second Alternative

'Cette fois-ci nous serons à temps au théâtre', dit Jules à sa femme, regardant sa montre et calculant le temps de métro qu'il fallait faire. Sa femme fit un signe de la tête.

Arriver à temps, oui; entrer dans la salle, non! Car Jules avait laissé les deux billets sur la table de son bureau où il les avait mis pour les prendre au dernier moment.

Ne se rappelant même pas les numéros des places, Jules dut retourner à la maison pour les chercher. Lorsqu'il revint enfin, sa femme l'attendait avec un petit sourire:

'Oui, nous serons à temps . . . pour le deuxième acte!'

NOTE. *The examiner is requested to underline the mistakes made by the candidate in reading the test passage.*

ENGLISH LITERATURE 210/1

ORDINARY LEVEL

(*Two hours and a half*)

There is an allowance of ten minutes extra for you to study the questions before you begin to write your answers.

Answer **five** *questions in all, of which at least* **three** *should be taken from Section* A, *and at least* **one** *from Section* B.

SECTION A

Answer at least **three** *questions (but not more than* **four**) *from this Section, selecting your questions from at least* **two** *books.*

CHAUCER: *The Pardoner's Prologue and Tale*

1. Choose **two** of the passages (*a*) to (*c*) and answer the questions which follow:

(*a*) *Bulles of popes* and of cardynales,
Of patriarkes and bishoppes I shewe,
And in latyn I speke a wordes few
To saffron with my predicacioun,
And for to stire hem to devocioun;
Thanne shewe I forth my *longe cristal stones*
Y-crammed ful of *cloutes* and of bones.

(i) Rewrite the passage as a whole in fluent modern prose, paying careful attention to the italicized words and phrases.

(ii) Name **two** objects, other than those mentioned in the passage, which the Pardoner carried about with him.

(iii) Describe any **one** of the wonders which he claimed could be performed by means of **one** of these relics.

(*b*) Thou fallest as it were a *styked swyn*;
Thy tonge is lost and al thyn *honeste cure*;
For dronkenesse is *verray sepulture*
Of mannes *wit* and his discrecioun;
In whom that drynke hath dominacioun,
He kan no conseil kepe, *it is no drede.*

(i) Rewrite the passage as a whole in fluent modern prose, paying careful attention to the italicized words and phrases.

(ii) Give **two** further details from the Pardoner's description of the appearance and behaviour of a drunk man.

(iii) Describe one of the instances taken from history which the Pardoner quotes in support of his denunciation of gluttony.

(*c*) The child seith *sooth*, for he hath slayn this yeer
Henne over a mile, withinne a greet village,
Bothe man and womman, child, and *hyne, and page*;
I trowe his habitacioun be there;
To been avysed greet wysdom it were,
Er that he dide a man *a dishonour.*

(i) Rewrite the passage as a whole in fluent modern prose, paying careful attention to the italicized words and phrases.

(ii) Who is "the child" and what had he been asked to do?

(iii) Give the substance of the child's reply to this request.

2. The Pardoner describes himself as "a ful vicious man". What grounds do you find, in his Tale and in the Prologue to it, for agreeing with his estimate of himself? What can be said in defence of the Pardoner?

3. (i) Give a clear but concise *summary* of the story told by the Pardoner;

and (ii) show how the Pardoner links the story with his sermon, making clear what points of the sermon are illustrated in it

4. What impressions have you gained, from studying *The Pardoner's Prologue and Tale,* of **three** of the following aspects of everyday life in Chaucer's time: (*a*) speech; (*b*) pastimes; (*c*) food and drink; (*d*) fear of death; (*e*) the difficulties and dangers of travel?

SHAKESPEARE: *Henry V*

5. Choose **three** of the passages (*a*) to (*d*) and answer *briefly* the questions which follow:

(*a*) *Canterbury.* O, let their bodies follow, my dear liege,
With blood and sword and fire to win your right!
In aid whereof we of the spiritualty
Will raise your Highness such a mighty sum
As never did the clergy at one time
Bring in to any of your ancestors.
King Henry. We must not only arm t' invade the French,
But lay down our proportions to defend
Against the Scot.

(i) For what purpose has the King summoned the Archbishop into his presence on this occasion; what two questions does he put to the Archbishop?

(ii) Why was the Church interested in persuading the King to declare war?

(iii) Outline **one** of the arguments by which Canterbury convinces the King that he need not fear the Scots.

(*b*) *Hostess.* As ever you came of women, come in quickly to Sir John. Ah! poor heart! he is so shak'd of a burning quotidian tertian that it is most lamentable to behold. Sweet men, come to him.

Nym. The King hath run bad humours on the knight; that's the even of it.

Pistol. Nym, thou hast spoke the right;
His heart is fracted and corroborate.

(i) State **two** of the causes of the quarrel between Nym and Pistol, which the Hostess here interrupts. How are the two men reconciled in this scene?

(ii) What does Nym mean by "the King hath run bad humours on the knight"; and Pistol by "his heart is fracted and corroborate"?

(iii) Quote **three** of the phrases descriptive of Sir John on his death-bed spoken later by the Hostess.

(*c*) This story shall the good man teach his son;
And Crispin Crispian shall ne'er go by,
From this day to the ending of the world,
But we in it shall be remembered—
We few, we happy few, we band of brothers.

(i) What had been said by Westmoreland that was answered in the King's speech from which these lines are taken?

(ii) Explain "Crispin Crispian shall ne'er go by".

(iii) How does the King in the next few lines of this speech explain "we band of brothers"?

(iv) Give **two** traits of the King's character which are shown in the speech from which this passage is taken.

(*d*) *King Henry.* Bring me just notice of the numbers dead
On both our parts. Call yonder fellow hither.
[*Points to Williams.*]
Exeter. Soldier, you must come to the King.
King Henry. Soldier, why wear'st thou that glove in thy cap?
Williams. An't please your Majesty, 'tis the gage of one that I should fight withal, if he be alive.
King Henry. An Englishman?

(i) What are (roughly) the "numbers dead on both our parts", and what does the King say about them?

(ii) What else does Williams tell the King about the "gage"? What does Fluellen think of the matter?

(iii) Say briefly how the King then arranges that Fluellen shall be drawn into the "fight".

6. "*Henry V* depicts the glories of war, but also its cruelty, treachery, and horror." Show by close reference how some or all of these characteristics are illustrated in:

(*a*) the speech of Chorus beginning "Now all the Youth of England are on fire";

(*b*) the speeches of the Duke of Burgundy;

(*c*) the capture of Harfleur.

7. Give a clear and concise account of **two** of the following episodes:

(*a*) King Henry's talk with his men on the night before the battle of Agincourt.

(*b*) The quarrel between Fluellen and Pistol, and the avenging of the insult.

(*c*) The unmasking of the treachery of Cambridge, Scroop, and Gray.

8. Give some account of scenes in the first four Acts of the play in which the King of France, the Dauphin, and the Constable appear, showing how Shakespeare points the contrast between the English and the French courts.

SHAW: *Pygmalion*

9. Choose **three** of the passages (*a*) to (*d*) and answer *briefly* the questions which follow:

(*a*) *Higgins*. I feel a sort of rough justice in his claim.

Doolittle. Thats it, Governor. Thats all I say. A father's heart, as it were.

Pickering. Well, I know the feeling; but really it seems hardly right—

Doolittle. Dont say that, Governor. Dont look at it that way. What am I, Governors both? I ask you, what am I? I'm one of the undeserving poor: thats what I am. Think of what that means to a man. It means....

(i) What is the "claim" which Doolittle has been making?

(ii) Give any **two** points from Doolittle's speech saying what it means to be one of the "undeserving poor".

(iii) What offer does Pickering make to Doolittle? Briefly summarize Doolittle's objection to the offer, and say what settlement he finally accepts.

(*b*) *Pickering.* If this girl is to put herself in your hands for six months for an experiment in teaching, she must understand thoroughly what she is doing.

Higgins. How can she? Shes incapable of understanding anything....Give her her orders: thats what she wants.

(i) What are the "orders" that Higgins proceeds to give Eliza?

(ii) What is the "experiment in teaching", and what bet do Higgins and Pickering make on it?

(iii) What annoys Eliza in the attitude of Higgins when the bet is finally won? How does she show her annoyance?

(*c*) *Higgins.* Well, here we are, anyhow! And now, what the devil are we going to talk about until Eliza comes?

Mrs Higgins. Henry: you are the life and soul of the Royal Society's soirees; but really youre rather trying on more commonplace occasions.

(i) Name the people included in Henry's "Here we are", and say what the occasion is.

(ii) Say briefly what they do in fact talk about until Eliza comes. How does Eliza start the conversation after her arrival?

(iii) Summarize any **two** further criticisms of her son's behaviour made by Mrs Higgins in the course of the play.

(*d*) *Liza.* Will you drop me altogether now that the experiment is over, Colonel Pickering?

Pickering. Oh dont. You mustnt think of it as an experiment. It shocks me, somehow.

Liza. Oh, I'm only a squashed cabbage leaf—

Pickering. No.

Liza. —but I owe so much to you that I should be very unhappy if you forgot me.

(i) Explain Eliza's reference to herself as "a squashed cabbage leaf".

(ii) What was Colonel Pickering's official part in the experiment?

(iii) Mention **three** things which Eliza says she owes to Pickering, or has learnt from him.

10. (i) Give a concise account of the first scene of the play in Covent Garden;

and (ii) how does Shaw use, in the later development of the action, the people and incidents introduced in this scene?

11. **Either** (*a*) Say what impression you have formed of **two** of the following, making quite clear how each of the two characters you choose comes to be involved in the action of the play: (i) Mrs Higgins; (ii) Mrs Pearce; (iii) Colonel Pickering.

Or (*b*) Which aspects of *Pygmalion* seem to you to be out of date now, and which to be still true to life as we know it today?

12. Mrs Higgins, speaking of Eliza, says to her son: "I'm afraid you've spoiled that girl, Henry."

(i) In what ways does Eliza change, between her first meeting with Henry and the end of the play? (ii) Do you yourself think she was "spoiled" by Henry or not? Justify your answer by close reference to what she says and does in the play.

N.B. Candidates may answer questions on **either** Tennyson, *Selected Poems*, **or** Belloc, *Essays*, **but not on both.**

TENNYSON: *Selected Poems*

13. Choose **three** of the passages (*a*) to (*d*) and answer *briefly* the questions which follow:

(*a*) She knows not what the curse may be,
And so she weaveth steadily,

And little other care hath she,
The Lady of Shalott.
And moving thro' a mirror clear
That hangs before her all the year,
Shadows of the world appear.

(i) What had the Lady been forbidden to do, under pain of a curse? What finally made her disobey the command?

(ii) Quote or refer closely to **two** passages describing the landscape round the Castle of Shalott.

(iii) Give **three** details from Tennyson's description of the Lady's arrival in Camelot.

(*b*) Most blameless is he, centred in the sphere
Of common duties, decent not to fail
In offices of tenderness, and pay
Meet adoration to my household gods,
When I am gone.

(i) Whom is Ulysses describing here, and what task is he proposing for him?

(ii) How does Ulysses describe the people of his country at the beginning of the poem? Why does he feel unsympathetic towards them?

(iii) Describe the scene when Ulysses sets sail.

(*c*) But when I met
Merlin, and ask'd him if these things were truth—
The shining dragon and the naked child
Descending in the glory of the seas—
He laugh'd as is his wont, and answer'd me
In riddling triplets of old time.

(i) Who is speaking here? What was Leodogran trying to find out from the speaker?

(ii) Say briefly what else we hear of Merlin in this poem.

(iii) Quote or give a full paraphrase of any two or three consecutive lines of the "riddling triplets".

(*d*) Me you call great: mine is the firmer seat,
The truer lance: but there is many a youth
Now crescent, who will come to all I am
And overcome it; and in me there dwells
No greatness, save it be some far-off touch
Of greatness to know well I am not great:
There is the man.

(i) To whom is Lancelot speaking, and on what occasion?

(ii) Give **three** details from Tennyson's description of Arthur ("There is the man") as he appeared on this occasion.

(iii) Rewrite in your own words lines 2–4 of the passage ("but there is many...overcome it") so as to bring out clearly their meaning.

14. **Either** (*a*) State briefly in your own words the theme of the poem which begins "You ask me why, tho' ill at ease," in which Tennyson expresses his love of England. Mention **two** other ways in which he reveals this love, and illustrate them from the poems you have studied.

Or (*b*) By means of a consideration of **two or three** of the following characters, say what qualities you think Tennyson most admired in his heroes: (i) Arthur; (ii) Ulysses; (iii) Grenville; (iv) Lancelot.

15. Briefly relate the three different explanations which are offered of Arthur's origin, in *The Coming of Arthur*, and say how we come to hear of each explanation.

16. Here are two stanzas from one of Tennyson's lyrics. Illustrate from them the poet's skill in using words to suggest both sights and sounds, as well as to express a thought or a feeling:

I

The splendour falls on castle walls
And snowy summits old in story:
The long light shakes across the lakes,
And the wild cataract leaps in glory.

Blow, bugle, blow, set the wild echoes flying,
Blow, bugle; answer, echoes, dying, dying, dying.

II

O hark, O hear! how thin and clear,
  And thinner, clearer, farther going!
O sweet and far from cliff and scar
  The horns of Elfland faintly blowing!
Blow, let us hear the purple glens replying:
Blow, bugle; answer, echoes, dying, dying, dying.

Belloc: *Essays*

17. Choose **three** of the passages (*a*) to (*d*), and answer *briefly* the questions which follow:

(*a*) Mr Bilbury and Mr Newman were astonished that attempted homicide should cost so little in this singular country. They were still more astonished to discover that etiquette demanded a genial reconciliation of the two combatants under such circumstances, and they were positively amazed to find after that reconciliation that they were compatriots. It was their seconds who insisted upon standing the dinner that evening. The whole incident was very happily over save for one passing qualm which Mr Bilbury felt (and Mr Newman also) when he saw the gentleman, whom he had last met as the tri-coloured official of the Republic, passing through the restaurant singing....

(i) What is the title of this essay?

(ii) Explain briefly why Mr Bilbury and Mr Newman did not know that they were "compatriots".

(iii) When and where had Bilbury last met the "official of the republic", and why is he referred to as "tri-coloured"?

(iv) What are you meant to conclude when you read that Bilbury felt a "passing qualm" at seeing the "official" in the restaurant?

(*b*) There is an old story and a good one to teach us how to fight against any weakness of the sort, which is this. Two old gentlemen who had never met before were in a first-class railway carriage of a train that does not stop until it gets to Bristol. They were talking about ghosts. One of them was a parson, the other was a layman. The layman said he did not believe in ghosts. The parson was very much annoyed, tried to convince him, and at last said, "After all, you'd have to believe in one if you saw one." "No, I shouldn't," said the layman sturdily; "I should know it was an illusion."

(i) Explain clearly what is meant by "weakness of the sort".

(ii) Say briefly what the parson next said and did, and what the layman thought about it.

(iii) What do you conclude are Belloc's own opinions on the subject of this essay? How are they conveyed to the reader?

(*c*) He forgets all about God and creation and the rest of it, and allows himself a little separate diatribe against the idiocy of the ostrich before getting back to his theology. So I with sparrows. And now that I have taught you this lesson from Job, I will return to the matter of inaccuracy. Inaccuracy is also the breeder not only of good native phrases, but of excellent tales, like the well-rubbed, polished ancient, and now immutable story of the boy in buttons who got nervous at the grandeur of the bishop, and said, when the sleepy bishop asked who was knocking: "It's the Lord, my boy."

(i) What was the "lesson from Job"?

(ii) Explain clearly "So I with sparrows", showing how sparrows have found their way into an essay on Inaccuracy.

(iii) Why, according to Belloc, are men afraid of being inaccurate?

(iv) How in Belloc's opinion can inaccuracy sometimes breed tragedy instead of comedy?

(*d*) Then when I got nearer to the gun, and I looked closely at it, I saw something which I have seen so often in a million German things that it has become a commonplace for them in my mind, but I know it is perilous to whisper it on this side of the Channel. The thing that has become a commonplace in my mind is the fact that Germans cannot *make*, but can only *copy*. They have many negative virtues, very unsuited to their vast aberrations.

(i) Where had Belloc seen this gun, and why had it been put there?

(ii) Name **three** German "negative virtues", and explain what Belloc means by "unsuited to their vast aberrations".

(iii) What had Belloc seen on the gun? State clearly why he disliked what he saw.

18. By reference to **three or four** essays in this volume, illustrate the variety of ways in which Belloc has taught you how the interest and excitement of walks and tours may be increased.

19. **Either** (*a*) Belloc sometimes writes an "essay-story" to illustrate a point of view. Briefly summarize **two** such "essay stories", showing what point of view he wished to illustrate in each.

Or (*b*) What has Belloc to say on **three** of the following topics: Country bargaining; English Inns; Secondary and Primary impressions; Cats; Accents?

20. Give an outline of **one** of the following essays, showing what it reveals of the author: *On Song*; *The Honest Man and The Devil*; *An Educational Reform*; *The Spaniard*.

SECTION B

Answer at least **one** *question* (*but not more than* **two**) *from this section.*

SCOTT: *Quentin Durward*

21. How are (i) the cruelty and vindictive spirit of King Louis XI, and (ii) his superstitious nature, clearly shown during his stay in Peronne? Refer closely to at least two important incidents.

22. Describe vividly the episode in which the hanged Zamet Maugrabin is cut down by Quentin Durward, and say how Quentin is rescued from the Provost Marshal. Explain briefly but clearly why King Louis had ordered Zamet's death.

23. Which **two** of the following minor characters in *Quentin Durward* did you find most interesting? State briefly the part each plays in the story and make clear what particularly interested you in each: the Lady Hameline; Ludovic Lesly; De La Marck; John of Balue; Pavillon.

MRS GASKELL: *Cranford*

24. What impression have you formed from a reading of *Cranford* of the life, character, and outlook of (i) Miss Matilda Jenkyns, **and** (ii) **either** Captain Brown **or** Miss Pole.

25. **Either** (*a*) "What a different world from ours Cranford is, in all its outward forms! And yet how easily we recognize in it the enduring characteristics of any small society."

(i) What differences have struck you between the "world" of Cranford and that of today? (ii) What do you find in the novel of permanent interest and appeal?

Or (*b*) "Although the ladies of Cranford know all each other's proceedings, they are exceedingly indifferent to each other's opinions." By means of reference to events or discussions described in the novel, show how the characters take an interest in each other's actions and yet care little about each other's opinions.

26. Give a concise account of **two** of the following, showing in each case how the incident is developed to reveal some aspect of life in Cranford:

(*a*) Miss Betsy Barker's tea party;

(*b*) the engagement of Lady Glenmire to Mr Hoggins;

(*c*) the rumours of a robbery in Cranford.

STEVENSON: *Travels with a Donkey* and *An Inland Voyage*

27. Describe any **one** occasion when Stevenson camped out of doors. Your answer should include an account of (i) the site of the camp, (ii) any events that took place there, (iii) the thoughts and feelings aroused in Stevenson by the occasion.

28. **Either** (*a*) Say which you think suited Stevenson better as a companion, Modestine or "Cigarette", taking into consideration (i) Stevenson's own personality and needs, (ii) the conditions of the journeys, and (iii) the personalities of his companions.

Or (*b*) Illustrate from both the *Travels* and the *Voyage* the variety of interesting people whom Stevenson met on his journeys. (You should refer to at least **two** people from each story.)

29. What does Stevenson say of **two** of the following? (Your account should include his reflections on the experience, as well as his description of it):

(*a*) the adventure of the capsized canoe;

(*b*) the stay at Origny Sainte-Benoîte;

(*c*) the performance by the marionettes at Précy;

(*d*) the visit to the cathedral of Noyon.

H. G. WELLS: *The History of Mr Polly*

30. Give a concise account of Mr Polly's fifteen years in the Fishbourne[1] shop, describing his domestic unhappiness, his gradual "deterioration", his quarrels with his neighbours and in the end his appearance before the county bench. How far do you think Mr Polly is himself responsible for his own unhappiness?

Some editions read Foxbourne.

31. **Either** (*a*) Choose **three** of the following phrases; say what Mr Polly meant by each and describe in some detail the scene or episode in which each of the chosen phrases is used: (i) Floriferous corner; (ii) gowlish gusto; (iii) allittrition's artful aid; (iv) looks pretty arsonical; (v) vorocious return to the heritage.

Or (*b*) What did Mr Polly learn from little Polly and the plump woman about Uncle Jim's character and past life? Describe briefly (i) Mr Polly's first meeting with Jim, and (ii) his *first* "campaign" against him.

32. "Port Burdock sparkled with the facets of a cluster of remembered jolly times."

"Canterbury was the most congenial situation Mr Polly ever found."

Give some account of the sort of things Mr Polly did, while he was working in his Burdock and Canterbury "cribs", that gave him pleasure.

220/1

THE LIFE AND TEACHING OF CHRIST AS CONTAINED IN THE SYNOPTIC GOSPELS

ORDINARY LEVEL

(*Two hours and a half*)

Answer Question 1 *and* **four** *other questions.*

Candidates are advised to spend about 40 *minutes on Question* 1.

1. Give the context of **five** of the following passages, commenting upon them as indicated:

(*a*) A voice was heard in Ramah,
Weeping and great mourning,
Rachel weeping for her children;
And she would not be comforted, because they are not.
(Matt. 2. 18.)

Show in what ways this Old Testament quotation was appropriate to the New Testament context.

(*b*) Ye offspring of vipers, who warned you to flee from the wrath to come? (Luke 3. 7.)

Write a note to show that you understand fully the meaning and purpose of this question.

(*c*) Can the sons of the bride-chamber fast, while the bridegroom is with them? (Mark 2. 19.)

Explain the reference to the "bridegroom."

(*d*) Behold, my mother and my brethren! (Mark 3. 34.)

What was the speaker teaching in this verse?

(*e*) I beheld Satan fallen as lightning from heaven. (Luke 10. 18.)

Explain this verse.

(*f*) No man eat fruit from thee henceforward for ever. (Mark 11. 14.)

In what respects might the incident here referred to be considered an acted parable?

(*g*) But when ye see the abomination of desolation standing where he ought not (let him that readeth understand), then let them that are in Judæa flee unto the mountains. (Mark 13. 14.)

Explain fully "the abomination of desolation."

(*h*) What further need have we of witnesses? Ye have heard the blasphemy: what think ye? (Mark 14. 63–4*a*.)

What does "blasphemy" mean here?

(*i*) He goeth before you into Galilee. (Mark 16. 7.)

Describe the scene which was the fulfilment of this promise.

2. Give a careful summary of the events connected with the birth and childhood of Jesus.

3. Write a short essay on "Jesus, the Healer," paying particular attention to the methods which he used.

4. Illustrate, from three parables, what Jesus taught about the Kingdom of Heaven.

SAMPLE 2

General Certificate of Education (GCE) Examination Papers "Advanced" (A) and "Scholarship" (S) Levels

Set by Cambridge University examining body for mathematics; by Oxford University examining body for physics and chemistry.

Age: 18.

MATHEMATICS 417/1

ADVANCED LEVEL

PAPER I

(*Two hours and a half*)

Answers to not more than **eight** *questions are to be given up. A pass mark can be obtained by good answers to about* **four** *questions, or their equivalent.*

Begin each answer on a fresh sheet of paper and arrange your answers in numerical order.

Mathematical tables and squared paper are provided.

1. (i) If $x=3+\sqrt{5}$ find the exact values of $x+\frac{4}{x}$ and $x^3+\frac{64}{x^3}$.

(ii) Solve the equations

$$2x+3y=1,$$
$$\frac{6}{x}-\frac{2}{y}=-5\tfrac{1}{2}.$$

2. (i) The least value of the function x^2+px+q is 3, and this occurs when $x=-2$. Find the values of p and q.

(ii) Find for what values of k the equation

$$x^2+(3k-7)\,x+(2k+6)=0$$

will have real roots in x.

3. (i) Find the coefficients of x^5 and x^{10} in the expansion of $(1-x)^4\,(1+x)^7$ in powers of x.

(ii) Show that, if x is *large*, so that $\frac{1}{x^2}$ and higher powers of $\frac{1}{x}$ can be neglected,

$$\frac{(x+2)^3}{(x-4)^2}=x+14+\frac{108}{x}.$$

4. Find the sum of n terms of the geometric progression

$$\tfrac{1}{2}+\tfrac{1}{6}+\tfrac{1}{18}+\dots.$$

[If a general formula is used, it must first be proved.]

Deduce the sum to infinity of this series.

Find the least number of terms of the series which must be taken for their sum to exceed $\frac{2999}{4000}$.

5. How many five-letter arrangements can be made from the letters of the word ROOMS? How many four-letter arrangements can be made from a selection of the same letters, (*a*) if both o's are included, (*b*) if no restriction is imposed on the choice of letters?

6. Prove that

$$\frac{\sin 5\theta}{\sin \theta}-\frac{\cos 5\theta}{\cos \theta}=4 \cos 2\theta.$$

By taking a particular value for θ, or otherwise, prove that $4 \cos 36° \cos 72° = 1$, and deduce that $\cos 36°$ is a root of the equation

$$8c^3-4c-1=0.$$

By removing the factor $2c+1$, obtain the value of $\cos 36°$ in surd form.

7. Assuming the sine rule for any triangle ABC, prove that its area is given by the formula $\frac{1}{2}c^2 \sin A \sin B \operatorname{cosec} C$.

The point A is 4 miles due west of the point B. From a point C in the same horizontal plane the bearings of A and B are S 18° 21′ W and S 49° 38′ E respectively. Calculate the area of triangle ABC and the perpendicular distance of C from AB, each correct to three significant figures.

8. (i) Find all possible pairs of angles A and B between 0° and 360° such that $A-B=240°$ and

$$\cos A+\cos B=0{\cdot}825.$$

(ii) Find all angles x between 0° and 360° such that

$$2 \tan x=4 \cot x+\operatorname{cosec} x.$$

9. By drawing graphs of the functions $2\cos 3\theta+3$ and $4\sin 2\theta$ for values of θ from 0° to 90°, estimate as accurately as you can the roots, in this range, of the equation

$$2\cos 3\theta+3=4\sin 2\theta.$$

10. A geographical globe is a sphere with centre O and of radius R. Through two points A and B on the equator, whose difference in longitude is 2α, meridians (i.e. great half-circles through the poles) are drawn, intersecting the circle of latitude λ (North) at P and Q respectively. (Thus the angle contained between the planes of these meridians is 2α, and the angles POA, QOB are each λ.) If the angle contained between the planes OPQ, OAB is ϕ, prove that $\tan\phi=\tan\lambda\sec\alpha$.

If the angle POQ is 2θ, prove that $\sin\theta=\cos\lambda\sin\alpha$.

MATHEMATICS 417/2

ADVANCED LEVEL

PAPER II

(Two hours and a half)

Answers to not more than **eight** *questions are to be given up. A pass mark can be obtained by good answers to about* **four** *questions, or their equivalent.*

Begin each answer on a fresh sheet of paper and arrange your answers in numerical order.

Mathematical tables and squared paper are provided.

1. The vertices of a triangle are $A\,(x_1, y_1)$, $B\,(x_2, y_2)$, $C\,(x_3, y_3)$. The mid-point of the side BC is M, and G is the point on AM such that $\dfrac{AG}{GM}=2$. Calculate the coordinates of G, and deduce that the three medians of the triangle are concurrent.

The sides BC, CA, AB of the triangle are produced to P, Q, R respectively so that

$$\frac{BP}{CP}=\frac{CQ}{AQ}=\frac{AR}{BR}=k.$$

Calculate the coordinates of P, Q, and R and show that G is also the point of concurrence of the medians of the triangle PQR.

2. Show by calculation that the point $P(-9, -3)$ lies inside the circle

$$x^2+y^2+4x-8y-80=0.$$

Find the equations of the two circles which pass through P, touch the given circle, and have radii of 5 units.

3. The point P in the first quadrant lies on the ellipse $x^2/a^2+y^2/b^2=1$. The points $A'(-a, 0)$ and $A(a, 0)$ are the extremities of the major axis of the ellipse, and O is the origin. The tangent to the ellipse at P meets the axis of y at Q and meets the line $x=a$ at T. The chord $A'P$ meets the axis of y at M, and when produced meets the line $x=a$ at R. Prove that (i) $AT=TR$, (ii) $OQ^2-MQ^2=b^2$.

4. The point P on the hyperbola $xy=c^2$ is such that the tangent to the hyperbola at P passes through the focus of the parabola $y^2=4ax$. Find the coordinates of P in terms of a and c.

If P also lies on the parabola, prove that $a^4=2c^4$, and calculate the acute angle between the tangents to the two curves at P.

5. (i) Differentiate with respect to x

(a) $x^3(1-2x^2)^5$, (b) $\sqrt{\sec(px+q)}$.

(ii) Using the method of small increments, find the value of $\log_{10}\tan 45^\circ 1'$ correct to five decimal places.

[Take $\pi=3{\cdot}142$ and $\log_{10} e=0{\cdot}4343$.]

6. (i) If $x=a\theta+b\sin\theta$ and $y=a-b\cos\theta$, where a and b are constants, find $\frac{dy}{dx}$ in terms of θ, and prove that

$$\frac{d^2y}{dx^2}=\frac{b(a\cos\theta+b)}{(a+b\cos\theta)^3}.$$

(ii) The formula $\theta=27+36e^{-t/6}$ gives the temperature θ degrees of a body t minutes after being placed in a certain room. Find after how many minutes the rate of cooling of the body will have fallen below one degree per minute, giving the answer correct to one decimal place.

7. Find the real root of the equation $x^3+3x-6=0$, correct to two decimal places.

8. (i) Integrate $\dfrac{6-13x}{x^2(3-2x)}$ with respect to x.

(ii) Expand the function

$$\log_e(1-x^3)-\log_e(1-x)$$

in ascending powers of x as far as the term in x^6. By making use of the factors of $(1-x^3)$ and giving an appropriate value to x, calculate the value of $\log_e 1{\cdot}24$ correct to four decimal places.

9. (i) If $\dfrac{d^2y}{dx^2}=(1-2x)^{-\frac{1}{2}}$ and y and $\dfrac{dy}{dx}$ are each equal to 2 when $x=0$, find the value of y when $x=-\frac{3}{2}$.

(ii) By using the substitution $x=\pi-y$, prove that

$$\int_0^\pi x\cos^2 x\,dx=\tfrac{1}{2}\pi\int_0^\pi \cos^2 x\,dx$$

and hence, or otherwise, find its value.

10. A hollow vessel has the form obtained by rotating through four right angles about the axis of y (i) the line $y=0$ from $x=0$ to $x=2$, (ii) the curve $4(y+1)=x^2$ from $x=2$ to $x=6$. Taking the units to be feet, calculate the capacity of the vessel, leaving the answer as a multiple of π.

If liquid is poured into the vessel, calculate the depth of the liquid when the centre of gravity of the liquid is at a height of 4 ft. above the base, giving the answer in feet correct to one decimal place.

[It is to be assumed that the axis of y is vertical.]

MATHEMATICS 417/3

ADVANCED LEVEL

PAPER III

(Two hours and a half)

Answers to not more than **eight** *questions are to be given up. A pass mark can be obtained by good answers to about* **four** *questions, or their equivalent.*

Begin each answer on a fresh sheet of paper and arrange your answers in numerical order.

Mathematical tables and squared paper are provided. In numerical work take g to be 32 ft. per sec.^{2}.

Mechanics

1. A rocket starts from rest at ground level and travels vertically upwards. For the first period of 5 sec. it moves with an acceleration of 100 ft. per sec.^{2}; for a second period of 5 sec. it moves with an acceleration of 50 ft. per sec.^{2}. At the end of the second period the propelling chemical becomes exhausted, so that the only force acting on the rocket is gravity. Ignoring air resistance, find to the nearest 100 ft. the greatest height reached above the ground, and find to the nearest second the total time which elapses from the start until it reaches the highest point.

2. Prove that the maximum range on a horizontal plane of a projectile fired with a speed V is V^2/g, neglecting air resistance.

A projectile is fired in such a trajectory that its range on a horizontal plane is four-fifths of its maximum range. Find the two possible directions of projection.

Show that the greatest heights reached in the two cases are $\frac{1}{10}R$ and $\frac{2}{5}R$, where R is the maximum range.

3. Two boats can signal to one another by means of lamps, the signals of which can be read at distances up to 10 nautical miles. One boat leaves harbour at midnight, and proceeds at 5 knots in a direction due north. Half an hour later the second boat leaves the same harbour and proceeds at 9 knots in a north-westerly direction. Find graphically the magnitude and direction of the velocity of the first boat relative to the second, and find the time at which they cease to be able to signal to one another by lamp.

[1 knot = 1 nautical mile per hour.]

4. A piledriver of weight 3 cwt. falls vertically under gravity from a height of 25 ft., and strikes without rebounding the upper end of a vertical pile of weight 7 cwt. If the resistance of

the ground is a uniform force of 30 cwt., find how far the pile is driven into the ground by each blow.

Find also the time for which the pile is moving during each blow.

[State the dynamical principle you are using at each stage of the question.]

5. Prove the formula $v^2 = n^2 (a^2 - x^2)$ for simple harmonic motion of amplitude a and period $2\pi/n$.

The tip of each prong of a tuning-fork sounding the note C makes 261 complete vibrations a second and may be taken to be moving in simple harmonic motion with amplitude 0·01 in. Calculate the maximum velocity and the maximum acceleration.

At a certain instant during the motion a tip is moving away from its mean position, and is passing through a point P at a distance of 0·005 in. from its mean position. Find the time which elapses before it next returns to P.

6. A particle of mass m is attached to one end of a light inextensible string of length l. The particle moves with a constant speed v in a horizontal circle on the inside of a fixed smooth hollow cylinder of radius r $(<l)$, the axis of which is vertical. The other end of the string is fastened to a fixed point on the axis of the cylinder. Show that the particle will remain in contact with the cylinder provided that

$$v^2 > \frac{r^2 g}{(l^2 - r^2)^{\frac{1}{2}}}.$$

Find also the reaction between the particle and the cylinder.

7. When a light elastic string of natural length 2 ft. is suspended vertically from one of its ends and supports a particle of mass 6 lb. at the other, its length is 2 ft. 4 in. The particle is now pulled aside until the string makes an angle of 30° with the vertical. Find the magnitude and direction of the least force which is required to hold the particle in this position.

Find the length of the string in these circumstances.

8. A uniform rectangular lamina $PQRS$ has $PQ=SR=2a$ and $PS=QR=2b$. The mid-points of QR and SR respectively are M and N. The triangle MRN is removed. Show that G, the centre of gravity of the remaining portion $PQMNS$, lies on PR, and find the distances of G from PS and PQ.

The lamina $PQMNS$ is hung freely under gravity from a pivot at P, and a weight w is attached at Q. If PM is now vertical, find the ratio of w to the weight W of this lamina.

9. A smooth hemispherical bowl is fixed with its axis vertical. A rod AB, of length l, rests partly inside and partly outside the bowl, with A at the lowest point of the bowl, and with one-third of its length outside the bowl. The rod is of weight W and its centre of gravity is at a distance c from its end A. Equilibrium is maintained by means of a horizontal force applied to the rod at B. Find this force and the reactions on the rod due to the bowl.

Show that this position of equilibrium is impossible if $c>\frac{1}{3}l$.

10. A uniform rod of weight W rests with its lower end on a rough horizontal floor and with its upper end against a rough vertical wall. The rod is in a vertical plane at right angles to the line of intersection of the floor and the wall. The coefficient of friction at each of the two contacts is μ. Show that the angle α made by the rod with the vertical when it is just on the point of slipping is $2\tan^{-1}\mu$.

The rod, remaining in the same vertical plane, is now moved until it makes an angle $\theta\ (>\alpha)$ with the wall. The rod is just prevented from slipping by applying a horizontal force $\frac{1}{4}W$ to the lower end of the rod in a direction perpendicular to the wall. If $\mu=\frac{1}{2}$, find $\tan\theta$.

Statistics

11. The following table shows the marks obtained by the same 150 candidates in two different papers in a recent examination:

	0–10	11–20	21–30	31–40	41–50
No. of candidates (Paper 1)	2	6	20	28	31
No. of candidates (Paper 2)	3	12	22	31	33

	51–60	61–70	71–80	81–90	91–100
No. of candidates (Paper 1)	20	17	11	8	7
No. of candidates (Paper 2)	15	14	9	9	2

Estimate the mean and median marks for Paper 1 only. If you were told that the true median mark for Paper 1 was in fact 48, what conclusion could you draw about the grouping of the marks?

Comment on the relative difficulty of the two papers.

12. (*a*) In a binomial distribution where the frequencies of occurrence of an event are given by the terms of the expansion of $N(p+q)^m$, the mean μ and the standard deviation σ of the distribution are given by the formulae

$$\mu = mp, \quad \sigma = \sqrt{mpq}.$$

Prove these formulae in the case where $m=3$.

(*b*) Two men A and B play a game in which A should win 8 games to every 7 won by B. If they play 3 games, show that the probability that A will win at least two games is approximately 0·55.

13. Explain the use of the formula $\sqrt{\frac{pq}{n}}$ for testing the significance of a proportion.

A coin was tossed 20,000 times. In the first 10,000 tosses 5075 heads were obtained. If the experiment had stopped there, would this have been significant evidence of bias?

In the second set of 10,000 tosses 5100 heads were obtained. To what conclusion does this lead? Give reasons for your answers.

14. The first of the figures in each of the following brackets shows the age in years and months, and the second shows the height in inches, of the 10 boys in a class. For example the bracket (16.5, 70) means that one boy is 16 yr. 5 m. in age and 70 in. in height.

(16.5, 70), (15.4, 69), (16.7, 65), (16.0, 68), (15.1, 67), (17.3, 70), (14.9, 64), (16.11, 65), (14.4, 59), (15.3, 63).

Calculate the coefficient of correlation between age and height and comment on your result.

[You may assume the following numbers. The mean age is $15.9\frac{1}{2}$, the mean height is 66. The sum of the squared deviations of the ages from $15.9\frac{1}{2}$ is $1248\frac{1}{2}$; that of the heights from 66 is 110.]

MATHEMATICS 417/0

SCHOLARSHIP PAPER

PAPER IV

(Three hours)

Begin each answer on a fresh sheet of paper and arrange your answers in numerical order.

Mathematical tables and squared paper are provided.

1. From the inequalities

$$y-2x>0, \quad x+y>3, \quad 2y-x<5$$

deduce that

$$\tfrac{1}{3}<x<\tfrac{5}{3}, \quad 2<y<\tfrac{10}{3},$$

and hence that the given inequalities cannot be satisfied simultaneously by integral values of x and y.

2. Prove that the number of ways of sharing £N between n charities, so that each charity receives a whole number of pounds (which may be zero), is equal to the coefficient of x^N in the expansion of $(1-x)^{-n}$ in ascending powers of x.

3. Express $\tan 5x$ in terms of $\tan x$. [The formula

$$\tan(A+B)=(\tan A+\tan B)/(1-\tan A \tan B)$$

may be assumed.]

Deduce an expression for $\tan \frac{7}{10}\pi$, and evaluate it with the aid of the tables of square roots.

4. A comet P describes a parabola with the sun S as focus. The coordinates of P are taken to be $(ap^2, 2ap)$. If the rate of change of p is proportional to $(1+p^2)^{-1}$, prove (i) that the square of the velocity of P is inversely proportional to the distance SP, (ii) that the velocity varies inversely as the perpendicular distance of S from the tangent at P.

5. Obtain an expression for the area of a triangle with vertices at the points (x_1, y_1), (x_2, y_2), (x_3, y_3).

The points A, B, C on an ellipse have coordinates

$$(a \cos \phi, b \sin \phi),$$

where $\phi = \alpha, \beta, \gamma$ respectively. If A and B are fixed and C is variable, find the condition for the area of the triangle ABC to be stationary. Find the greatest value of the area if A, B, and C are all variable, and show that there are an infinite number of triangles with this area.

6. By investigating the turning points of the function

$$x^3 - 6x^2 + C,$$

find for what values of the constant C the function vanishes for three distinct real values of x.

When C has the value 5, the function vanishes for $x = 1$. If C has the value $5 + k$, where k is small, find approximately the value of x near 1 for which the function vanishes, expressing your answer in the form $1 + \alpha k + \beta k^2$, where α and β are numerical constants to be determined.

7. If

$$y = ae^{-px} \sin (qx + c),$$

where a, p, q, c are constants, show that

$$\frac{dy}{dx} = a' e^{-px} \sin (qx + c'),$$

where

$$a' = a (p^2 + q^2)^{\frac{1}{2}} \quad \text{and} \quad c' = c + \frac{\pi}{2} + \tan^{-1} \frac{p}{q}.$$

Write down a formula for $\dfrac{d^n y}{dx^n}$.

Show that the points at which $\dfrac{dy}{dx} = 0$ lie on the curves $y = \pm Ae^{-px}$ for a certain value of A; determine A.

8. As a result of an atomic explosion that takes place above a place X on the Earth's surface, radioactive atoms are deposited on the ground. If the number of atoms per unit area at a distance r from X is σe^{-kr^2}, where σ and k are constants, show that the total number of atoms deposited is $\pi\sigma/k$.

Find (i) the distance r from X at which the number of atoms per unit area has half its greatest value, and (ii) the radius of the circle within which half of the total number of atoms are deposited.

[The Earth's surface is to be assumed flat.]

9. Two uniform rods AB and BC, each of weight W and length $2a$, are hinged at B. The joint at B is stiff and requires the application of a couple of moment M to bend it. The system rests in equilibrium in a vertical plane with the ends A and C in contact with a rough horizontal plane; the coefficient of friction at A and C is μ. Show that

$$M \geqslant Wa\,(\sin\alpha - 2\mu\cos\alpha),$$

where α is the angle of inclination of the rods to the vertical.

Find the condition that equilibrium should be possible for all values of α.

10. A particle, of mass m and electric charge q, moves in a plane under the action of a magnetic field, of intensity H, at right angles to the plane. Given that the magnetic field exerts on the particle a force of magnitude qvH/c (where c is a constant and v is the velocity), and that this force lies in the plane and is at right angles to the direction of motion, prove that it is possible for the particle to move in a circle with constant speed. Show that the time taken to describe the circle is independent of the radius.

If, when the particle is moving in a circle of radius r, its kinetic energy is suddenly increased by a small amount ϵ, calculate, correct to the first order in ϵ, the increase in the radius of the circle described by the particle.

11. Two spheres, of masses m_1 and m_2, move along the same straight line with velocities u_1 and u_2 respectively. They collide, and after impact their velocities become v_1 and v_2 (all velocities being measured in the same sense). If A is the stage during which the velocities change from u_1 and u_2 to a common value, V say, and if B is the stage during which they change from this

value to v_1 and v_2, prove the equivalence of the following equations:

(i) $v_2 - v_1 = e\,(u_1 - u_2)$,

(ii) $I_B = eI_A$,

where I_A is the impulse of the force of interaction during stage A, and I_B is similarly defined.

12. An experimental truck was propelled along a straight track AB of length 2000 yd., and its speed was measured at stations spaced at intervals of 100 yd. The following speeds, averaged over 40 runs, were found:

	Distance from A (yd.)				Distance from B (yd.)			
	50	150	250	350	350	250	150	50
Mean speed (m.p.h.)	100·6	100·8	100·9	101·2	99·9	99·8	99·4	99·4

Show these results on a regression diagram, and sketch in by eye straight regression lines for the mean speed in these parts of the track. Hence obtain estimates for the mean speeds at A and B.

Would you regard these estimates as the best that can be derived from the data if it is known (*a*) that the speeds measured on each run closely approximate to the mean speeds given above, or (*b*) that in an individual run the measured speeds vary irregularly from station to station by as much as 1 m.p.h.?

FURTHER MATHEMATICS 437/1

ADVANCED LEVEL

PAPER I

(*Two hours and a half*)

Answers to not more than **eight** *questions are to be given up.*

A pass mark can be obtained by good answers to about **four** *questions, or their equivalent.*

Begin each answer on a fresh sheet of paper and arrange your answers in numerical order.

Mathematical tables and squared paper are provided.

1. Prove that if the equations

$$\left.\begin{array}{l} a_1x+b_1y+c_1z=0 \\ a_2x+b_2y+c_2z=0 \\ a_3x+b_3y+c_3z=0 \end{array}\right\}$$

are simultaneously satisfied by values of x, y, z which are not all zero, then

$$\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} = 0.$$

Hence, or otherwise, eliminate x, y, z from the equations

$$a=\frac{x}{y-z}, \quad b=\frac{y}{z-x}, \quad c=\frac{z}{x-y}.$$

[Your answer should **not** be left in determinant form.]

2. Prove that the equations

$$\left.\begin{array}{l} \lambda x+y+z=1 \\ x+\lambda y+z=4 \\ x+y+\lambda z=\mu \end{array}\right\}$$

are simultaneously satisfied by finite values of x, y and z, unless $\lambda=1$ or -2.

Prove that, if $\lambda=1$, there is no solution, and that, if $\lambda=-2$, there is no solution unless μ has a certain value. Find this value, and for this case express x and y in terms of z.

3. Prove that the feet of the perpendiculars from any point P on the circumcircle of a triangle to the sides of the triangle lie on a straight line (the Simson's line of P).

The altitudes from the vertices B, C of an acute-angled triangle ABC meet the circumcircle in Q, R respectively. Prove that the Simson's lines of Q and R intersect at an angle equal to $2\angle BAC$.

4. The altitudes through the vertices A, B, C of an acute-angled triangle intersect at H and meet the opposite sides at D, E, F respectively. Prove that H is the in-centre of triangle DEF, and locate the ex-centres.

Prove that the radii of the escribed circles of triangle DEF are in the ratio $AF.AB : BD.BC : CE.CA$.

5. Two non-intersecting circles S, S' are in the same plane π, and l is their radical axis. S' is rotated about l out of the plane π into a new position S''. Prove that S'' and S are sections of the same sphere.

If the centres of S and S' are 24 cm. apart, and their radii are 8 cm. and 4 cm., and the angle of rotation is a right angle, prove that the radius of the sphere is $\sqrt{185}$ cm.

6. If A, B are two points on the same side of a line CD, give a construction for finding a point P on CD (other than the point of intersection of AB and CD), such that AP and BP are equally inclined to CD.

Find the co-ordinates of P, if CD is the line $3x-2y=8$ and A, B are the points $(20, 13)$, $(5, -3)$.

7. Obtain the general equation of a circle of the coaxal system which has $(1, 2)$ and $(4, 6)$ as limiting points.

Find the equations of the two circles of the system which are of radius $5\sqrt{2}$.

Prove that the external common tangents of these two circles are both of the form $4x-3y=k$, and find the two values of k.

8. Prove that the equation of the tangent at (x_1, y_1) to the parabola $y^2=4ax$ is $yy_1=2a(x+x_1)$, and deduce the equation of the chord of contact of tangents drawn from an external point (x', y') to the parabola.

If the chord of contact touches the circle $x^2+y^2=4a^2$, prove that (x', y') lies on a certain rectangular hyperbola, and sketch the hyperbola and the parabola in one figure.

Comment on the fact that part of the hyperbola lies inside the parabola and consists of points from which no real tangents can be drawn.

9. If OP, OQ are perpendicular semi-diameters of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, find the value of $\frac{1}{OP^2}+\frac{1}{OQ^2}$, showing that it is independent of the position of P.

If OP is inclined at an angle θ to the axis of x, prove that

$$PQ^2=\frac{4a^2b^2\,(a^2+b^2)}{(a^2+b^2)^2-(a^2-b^2)^2\cos^2 2\theta},$$

and find the greatest and least possible values of PQ.

10. State the co-ordinates of the foci and the equations of the directrices of the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$.

A line drawn (in the first quadrant) through the focus S of the hyperbola $\frac{x^2}{16}-\frac{y^2}{9}=1$ perpendicular to the axis of x meets the hyperbola at P. The tangent at P meets the asymptotes at Q, Q'. Prove that QQ' is divided by the directrix corresponding to S in the ratio $1:4$.

FURTHER MATHEMATICS 437/2

ADVANCED LEVEL

PAPER II

(Two hours and a half)

Answers to not more than **eight** *questions are to be given up.*

A pass mark can be obtained by good answers to about **four** *questions, or their equivalent.*

Begin each answer on a fresh sheet of paper and arrange your answers in numerical order.

Mathematical tables and squared paper are provided.

1. Prove that no part of the curve

$$y^2=\frac{x^2\,(x^2-4)}{(x^2+1)\,(x^2-1)}$$

lies between the lines $x=1$ and $x=2$.

State what symmetry the curve possesses, and give the equations of the four asymptotes and of the tangents to the curve at the origin.

Sketch the curve.

2. Find values of a, b, c, d independent of r such that

$$5r^4+r^2 \equiv ar^2(r+1)^3+br^3(r+1)^2+cr^2(r-1)^3+dr^3(r-1)^2.$$

Hence or otherwise prove that

$$\sum_{r=1}^{n} r^4 = \tfrac{1}{30}n(n+1)(2n+1)(3n^2+3n-1).$$

3. (i) Solve the inequality

$$\sqrt{x+2}-\sqrt{x-1}>\sqrt{2x-3}$$

for real values of x and of the square roots.

(The positive values of the square roots are to be taken.)

(ii) Prove, by considering the turning-points on the graph $y=x^3-3a^2x+b$ or otherwise, that if the equation $x^3-3a^2x+b=0$ has three distinct real roots, then $4a^6>b^2$.

4. (i) Show how the sum of two complex numbers z_1, z_2 may be represented by a point in an Argand diagram.

If $z_1, z_2, \ldots z_n$ are complex numbers, show that

$$|z_1+z_2+\ldots+z_n| \leqslant |z_1|+|z_2|+\ldots+|z_n|,$$

stating the condition for equality.

If $|z_1|=|z_2|$, prove that the amplitude (argument) of $(z_1+z_2)/(z_1-z_2)$ is $\pi/2$ or $3\pi/2$.

(ii) If $|z-4+3i|<1$, prove by means of an Argand diagram or otherwise that $4<|z|<6$.

5. Find the general solutions of the equations

(i) $\cot 3\theta=\tan\theta$,

(ii) $\sin 3\theta=3\tan\theta$,

(iii) $8\sin^2\theta-\sin\theta\cos\theta-2=0$.

6. Use Maclaurin's expansion to obtain expressions for $\sin^{-1}x$ and $\tan x$ in ascending powers of x as far as the term in x^3 in each case.

Prove that, to the same degree of approximation,

$$\sin^{-1}(\tan x) - \tan^{-1}(\sin x) = x^3.$$

7. Integrate with respect to x

(i) $\sin^5 x \cos^2 x$,

(ii) $(1 + \cosh x)^{-1}$.

Prove that

$$\int_1^e x^2 (\log x)^2 \, dx = \tfrac{1}{27}(5e^3 - 2).$$

8. Prove that the moment of inertia of a uniform solid sphere of mass M and radius a about a diameter is $\frac{2}{5}Ma^2$.

A centrifugal governor consists essentially of two uniform solid spheres, each of radius a and mass $10M$, and two uniform rods of length $4a$ and mass M attached one to the surface of each sphere. The other ends of the rods are hinged to the top of a vertical shaft, and the line of each rod produced would pass through the centre of a sphere. Prove that the moment of inertia of the system about the shaft when the rods are inclined at 30° to the shaft is $\frac{407}{3}Ma^2$.

9. Sketch the curve for which parametric equations are

$$x = \theta - \sin\theta, \quad y = \cos\theta,$$

considering only values of θ from 0 to 2π.

This portion of the curve cuts the x-axis at P and Q. The area enclosed between the arc PQ of the curve and the x-axis is revolved through four right angles about the x-axis. Find the surface area of the solid of revolution thus formed.

10. Given that

$$\frac{dx}{dt} + 2x = \frac{dy}{dt} + x + y - t = 0,$$

eliminate x to obtain a second order differential equation for y as a function of t.

Hence prove that if $y = \dfrac{dy}{dt} = 0$ when $t = 0$,

$$y = e^{-t} + t - 1.$$

FURTHER MATHEMATICS 437/3

ADVANCED LEVEL

Paper III

(Two hours and a half)

Each question marked with an asterisk carries about two-thirds of the marks assigned to each of the remaining questions.

Full marks may be obtained by complete answers to the equivalent of eight questions not marked with an asterisk.

Begin each answer on a fresh sheet of paper and arrange your answers in numerical order.

Mathematical tables and squared paper are provided. In numerical work take g to be 32 ft. per sec.^{2}

*1. Two light inextensible strings AB and BC are joined at B, and the end A of the string AB is fixed. A particle of weight $2W$ is attached at B and a particle of weight W at C. The latter particle is pulled by a force W in a direction inclined at 60° to the upward vertical through C. Calculate the inclinations of the strings AB and BC to the horizontal and the tension in each, when the system is in equilibrium.

*2. A cylindrical tin rests with its base, of radius $3a/2$, on horizontal ground. Two smooth spheres, each of radius a and weight W, are placed inside the tin. Calculate the reactions between the spheres and the tin and show that the system is in equilibrium whatever the weight of the tin.

Calculate also the reaction between the spheres.

*3. A particle starts from rest and moves for a time with uniform acceleration; it then travels for twice that time at a uniform speed, after which it is retarded uniformly to rest, the magnitude of the retardation being three times that of the acceleration. If the total time is 10 sec. and the distance travelled is 360 ft., calculate the distance from the starting-point after $7\frac{1}{2}$ sec. and the speed after $9\frac{1}{2}$ sec.

*4. A car weighing 1 ton travels, with engine switched off, down a hill of 1 in 20 (i.e. $\sin^{-1} 1/20$) at a uniform speed of 5 m.p.h. When the car reaches level ground, the engine is switched on and works at 8 H.P. Calculate the initial acceleration in ft. per sec.^{2}, correct to one decimal place.

5. The axles of a truck are at a distance a apart and the centre of gravity of the truck is at a distance b from the ground and equidistant from the axles. Show that, with only the lower pair of wheels locked, the truck will slip on an inclined plane if the inclination is greater than α, where $\tan\alpha = \frac{\mu a}{2(a-\mu b)}$ and μ is the coefficient of friction between the wheels and the incline.

Calculate the corresponding greatest incline on which the truck will rest with only the upper pair of wheels locked.

6. Show that the centre of gravity of a uniform semicircular plate of radius r is at a distance $4r/(3\pi)$ from the bounding diameter.

A uniform plate weighing w per unit area, is in the shape of an equilateral triangle OAB of side $2r$, with a semicircle described on AB and outside the triangle. The plate is suspended freely from O and a horizontal force X, in the plane of the plate, acts at B. Calculate X when the plate is in equilibrium with OA vertical.

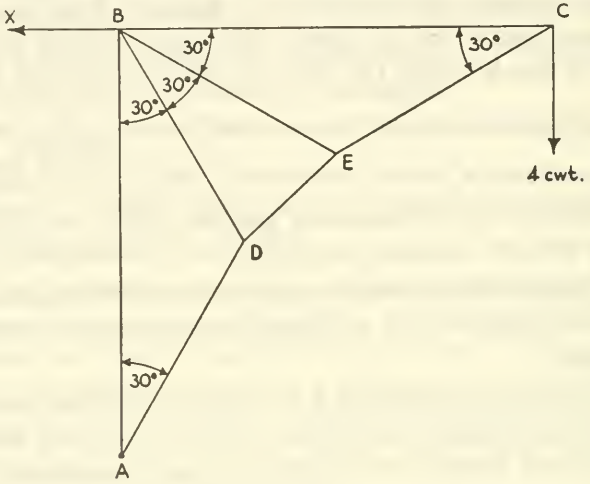
7. A small ring of mass m can slide on a smooth circular wire, with centre O and of radius a. The wire is fixed in a vertical plane and the ring is held at A where OA makes an angle of 60° with the upward vertical through O. The ring is now given a velocity u in a downward direction tangential to the wire. Calculate u, if the reaction between the wire and the ring in the lowest position is eight times the weight of the ring.

In this case, calculate

(i) the reaction between the ring and the wire when the ring is at the point diametrically opposite to A;

(ii) the impulse on the ring which would bring it to rest at the lowest point.

8. The diagram shows a freely jointed framework of seven light rods in a vertical plane. $AB = BC$; AB is vertical and there is a load of 4 cwt. at C. The joint A is hinged at a fixed point and X is a horizontal force to maintain equilibrium. Find, graphically or otherwise, the stresses in the rods BA, BD and BE, distinguishing between tension and compression.



9. On a plane of inclination α, AOB is a line of greatest slope. A particle is projected from O with velocity V so that motion takes place in a vertical plane through AOB. Calculate the greatest range up the plane.

If OA is the greatest range down the plane and OB is the greatest range up the plane, show that

$$\frac{1}{OA}+\frac{1}{OB}=\frac{1}{h},$$

where h is the greatest height which would be reached by a particle projected vertically upward with velocity V.

10. A particle of mass m is attached at B to two light elastic strings AB and BC each of natural length a and modulus of elasticity λ. The ends A and C are fixed so that AC is vertical and of length $3a$, with A above C. If the particle is released

from rest at the middle-point of AC, show that it oscillates in simple harmonic motion if $\lambda > 2mg$.

In this case, find the amplitude and the period of the motion, and show that the greatest tension in AB is $mg + \frac{1}{2}\lambda$.

11. A small ring of mass m, which can move on a smooth vertical wire, is attached to one end of a light inextensible string. The string passes over a small smooth pulley fixed at A and supports a particle of mass $2m$ hanging freely. The ring is released from rest at B, where AB is the perpendicular from A to the wire and $AB = a$. Show that, when the ring has descended a distance x to P,

$$\dot{x}^2 + 2\dot{y}^2 = 2g\,(x - 2y + 2a),$$

where AP is y.

Calculate the velocity of the ring after it has fallen a distance a, and show that it is instantaneously at rest after falling a distance $4a/3$.

12. Show that the radius of gyration of a uniform rod of length l about an axis through the centre and perpendicular to the rod is $l/(2\sqrt{3})$.

A uniform rod AB of mass $2m$ and of length $4a$ can turn freely in a vertical plane about a fixed horizontal axis perpendicular to the plane and through a point O of the rod where $OA = 3a$. A particle of mass m is attached at A and an equal particle at B. If the body is released when the rod is horizontal, show that the rod will pass through the vertical position with an angular speed of $[6g/(11a)]^{\frac{1}{2}}$.

Find the period when the body makes small oscillations as a compound pendulum.

FURTHER MATHEMATICS 437/0

SCHOLARSHIP PAPER

PAPER IV

(*Three hours*)

Candidates may attempt as many questions as they please, but marks will be assessed on the eight questions best answered.

Begin each answer on a fresh sheet of paper and arrange your answers in numerical order.

Mathematical tables and squared paper are provided.

1. The real numbers a, b, c, f, g, h satisfy the three conditions:

$$b>0; \quad bc-f^2>0; \quad abc+2fgh-af^2-bg^2-ch^2>0.$$

Prove that

$$ax^2+by^2+cz^2+2fyz+2gzx+2hxy>0$$

for all real values of x, y, z except $x=y=z=0$, and hence prove that

$$a>0,\ c>0,\ ac-g^2>0 \quad \text{and} \quad ab-h^2>0.$$

2. (i) Eliminate x from the equations

$$\left.\begin{aligned} ax^2+bx+c=0, \\ a'x^2+b'x+c'=0. \end{aligned}\right\}$$

(ii) Given that $\alpha+\beta+\gamma=2$, $\alpha^2+\beta^2+\gamma^2=14$ and

$$\alpha^3+\beta^3+\gamma^3=20,$$

find $\beta\gamma+\gamma\alpha+\alpha\beta$ and $\alpha\beta\gamma$. Hence find α, β, γ.

3. (i) Evaluate

$$(n-1)\,({}^nC_1)+(n-2)\,({}^nC_2)+\ldots+2\,({}^nC_{n-2})+{}^nC_{n-1}$$

and

$$\frac{{}^nC_1}{n}+\frac{{}^nC_2}{n-1}+\ldots+\frac{{}^nC_{n-1}}{2}+\frac{{}^nC_n}{1}.$$

(ii) By considering $(1-e^t)^{n+1}$, or otherwise, prove that

$$\sum_{r=0}^{n+1} {}^{n+1}C_r(-1)^r r^n=0.$$

4. (i) Show that for any complex numbers z_1, z_2 and any real number a

$$|\,az_1-z_2\,|^2+|\,z_1+az_2\,|^2=(1+a^2)\,(|z_1|^2+|z_2|^2).$$

(ii) If $x^2+y^2=1$, $z=x+iy$ and $u+iv=z^2+z+1$, show that

$$(u^2-2u+v^2)^2=u^2+v^2.$$

5. If $u=u(x)$ satisfies the differential equation

$$(1-x^2)\frac{d^2u}{dx^2}-2x\frac{du}{dx}+n(n+1)u=0,$$

find the differential equation of the second order satisfied by $y=\frac{d^mu}{dx^m}$, where m is a positive integer.

If $z=(1-x^2)^{\frac{1}{2}m}\frac{d^mu}{dx^m}$, show that z satisfies the equation

$$(1-x^2)\frac{d^2z}{dx^2}-2x\frac{dz}{dx}+\left\{n(n+1)-\frac{m^2}{1-x^2}\right\}z=0.$$

If $w=\frac{d}{d\theta}\{u(\cos\theta)\}$, prove that

$$\frac{d^2w}{d\theta^2}+\cot\theta\frac{dw}{d\theta}+\{n(n+1)-\operatorname{cosec}^2\theta\}w=0.$$

6. A family of curves is given by $y=x+\alpha e^x$, where α is a parameter. Find the differential equations of the two families of curves which intersect the members of the first family at an angle of 45°.

Of the two differential equations so obtained, solve that one which applies to the family the members of which cut the line $y=x$ in a direction parallel to the x-axis.

7. A circle C and an ellipse S lie in the same plane and are concentric. A point P moves in the plane so that the tangents from P to C separate harmonically those from P to S. Show that the locus of P is an ellipse with the same principal axes as S.

8. The points A, B have, respectively, the coordinates $(1, 0)$, $(0, 1)$. A conic S_1 is drawn through A, B and the points $(0, 2)$, $(1, 1)$, $(3, 0)$; a conic S_2 is drawn through A, B and the points $(-1, 0)$, $(2, 1)$, $(-1, -1)$.

(i) Find the equations of S_1 and S_2.

(ii) Find the equation of that conic through the common points of S_1 and S_2 which passes through the origin.

(iii) Show that a rectangular hyperbola can be drawn through the common points of S_1 and S_2, and find its equation.

(iv) Find the equation of that common chord of S_1 and S_2 which does not pass through either A or B.

9. A particle of weight W is held at rest on a rough plane inclined to the horizontal at a fixed (acute) angle α by a light string which makes an angle $\beta\,(\leqslant \tfrac{1}{2}\pi - \alpha)$ with an upward line of greatest slope in the plane. The angle of friction between the particle and the plane is λ. If the particle is just on the point of slipping up the plane, find an expression for the tension T in the string in terms of W, λ, α and β.

Find the greatest and least values of the tension T for varying β in the range $0 \leqslant \beta \leqslant \tfrac{1}{2}\pi - \alpha$, distinguishing carefully the cases which arise for different given values of α and λ.

10. A uniform solid cylinder of radius a is projected in a direction perpendicular to its axis along a rough horizontal table. The initial velocity of the axis of the cylinder is V and the cylinder has a backward spin of magnitude Ω. Show that after slipping has ceased the cylinder rolls on the table with constant velocity $(2V - a\Omega)/3$.

Describe in general terms the motion in the three cases $2V > a\Omega$, $2V = \alpha\Omega$, $2V < a\Omega$.

Show that if the cylinder has just returned to its starting-point at the moment when slipping ceases, then $5V = a\Omega$.

11. A bead of mass m moves under gravity on a smooth wire bent into an arc of the cycloid

$$x = a\,(\theta - \sin\theta), \quad y = a\,(1 - \cos\theta) \qquad (0 \leqslant \theta \leqslant 2\pi),$$

where the axis of x is horizontal and the axis of y points vertically downwards. The bead is released from rest at a point whose distance from the lowest point N of the wire, measured along the arc, is c. Find the speed with which the bead reaches N, and show that the reaction of the wire on the bead is then

$$mg\left(1 + \frac{c^2}{16a^2}\right).$$

12. Two equal particles P_1, P_2, each of mass m, are joined by a light inextensible string of length $2l$. The particles initially lie at rest on a smooth horizontal table with the string taut. At time $t=0$ the particle P_1 is given a velocity V at right angles to the string. Find expressions for the speeds of the particles after time t.

When $t=2\pi l/V$ the string comes into contact with a smooth peg fixed on the table. At the moment of contact the distance between P_2 and the peg is a. If during the subsequent motion the distance between P_2 and the peg is denoted by r, prove that for $2\pi l \leqslant Vt \leqslant 2\pi l+\sqrt{8l^2-2a^2}$

$$r^2=a^2+\tfrac{1}{2}(Vt-2\pi l)^2.$$

A 21/I

OXFORD LOCAL EXAMINATIONS
GENERAL CERTIFICATE OF EDUCATION
Summer Examination, 1958
Advanced and Scholarship Level
PHYSICS, PAPER I

MONDAY, JUNE 23. TIME ALLOWED—3 HOURS

[Write the number of the paper, A 21/I, on the left at the head of each sheet of your answers in the space provided.

Answer SIX questions only, including at least ONE question from each of the four sections of the paper.

Mathematical tables are provided.]

[Take g to be 981 cm./sec.^{2}]

SECTION A

1. Explain how the principle of Archimedes is applied to the determination of densities.

A cube of tungsten carbide alloy with 9 cm. sides weighs 10·00 kg. in air, and 0·20 kg. when totally immersed in mercury. Find the density of the alloy and that of mercury.

Assuming that brass weights were used, find the air-buoyancy correction for the first of these weighings.

[Take the density of brass to be 8·4 gm./c.c., and that of air to be 0·00126 gm./c.c.]

2. Define *moment of inertia*. Explain why a flywheel is made with most of its mass concentrated near the rim, and discuss briefly the part played by the flywheel in a single-cylinder engine.

A small flywheel is on an axle 3 mm. in diameter. The moment of inertia of the system about its axis is 3,000 gm. cm.^{2}, and it is set in motion by applying a steady tension of 100 gm. wt. to a thin thread wound round the axle. Assuming that the thread does not slip on the axle, and that there is no friction between the axle and its bearings, calculate (a) the angular acceleration while the thread is being pulled, (b) the angular velocity acquired by the flywheel when 50 cm. of thread has been pulled off the axle.

3. State the law of conservation of momentum, and describe how you would use a ballistic balance to demonstrate the law.

The two colliding bodies of a ballistic balance are hung by cords 2 metres long, and are arranged to stick together after impact. The body A, of mass 500 gm., is initially at rest; the other, B, of mass 700 gm., is released from rest at a point which is at a *horizontal* distance of 50 cm. from the point of collision. Find (a) the velocity of B before impact, (b) the common velocity after impact, and (c) the kinetic energy lost at the impact.

SECTION B

4. Explain the principles underlying the establishment of a scale of temperature, and discuss the meaning of the phrase '$t°$ C. on the constant volume gas thermometer scale'.

Describe the constant volume gas thermometer, and state its advantages and disadvantages as a practical instrument for temperature measurement.

Assuming that real gases obey van der Waals' equation

$$\left(p+\frac{a}{V^2}\right)(V-b)=RT,$$

where, for the individual gas concerned, a and b are constants and T denotes temperature on the ideal gas scale, show that readings on the constant volume gas scale for any gas should agree with those on the ideal gas scale.

5. State Newton's law of cooling, and describe how you would test it experimentally.

Discuss the factors that determine the rate of fall of temperature of a hot liquid contained in a calorimeter exposed to the air.

A calorimeter, of water equivalent 20 gm. and containing 150 c.c. of water, cools from 60° C. to 40° C. in 7 minutes. When the water is replaced by 150 c.c. of oil of specific gravity 0·8, the same calorimeter cools through the same temperature range in 4 minutes. Calculate the specific heat of the oil.

6. From the point of view of the kinetic theory, discuss the state of equilibrium between a liquid and its saturated vapour, and explain why the saturated vapour pressure of a liquid increases as the temperature rises.

Describe an experiment by which the saturated vapour pressure of water over the range 60° C. to 110° C. may be measured.

In Wollaston's cryophorus (Fig. 1), the sealed system contains water and water vapour only. When the bulb A is surrounded by a mixture of ice and salt, the water in B is eventually frozen. Explain this.

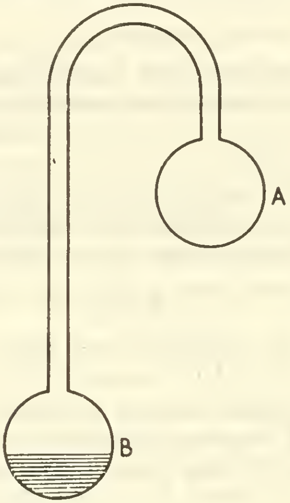


FIG. 1.

SECTION C

7. Explain, in terms of the wave theory of light, how a converging lens brings a plane wave-front to a focus.

A small object on the axis of a thin lens is at distance x from the first principal focus of the lens; its image is at distance y from the second principal focus of the lens. Prove from first principles that $|xy| = f^2$, where f is the focal length of the lens.

Describe how you would determine the focal length of a lens experimentally by a method involving the use of the above relation.

8. Distinguish between the *power* and the *magnifying power* of a simple magnifying glass and obtain a formula relating them.

A lens of power +20 D. is used as a magnifying glass by a man with a near-point distance of 25 cm. What is its magnifying power?

Describe how two thin lenses having appropriate focal lengths can be arranged to form a compound microscope. Draw a diagram showing the passage through the microscope of a pencil of rays which starts from an object point not on the axis of the instrument.

9. Describe an experiment by which you could demonstrate the difference between the composition of 'red light' as emitted from a neon discharge tube, and from the rear lamp of a car.

Give an account of the chief features of the sun's spectrum. What information do the Fraunhofer lines give about the composition of the outer regions of the sun?

Section D

10. Describe the quadrant electrometer. Explain how you would use this instrument to compare the capacities of two condensers when it is known that the capacity of the electrometer itself is negligible in comparison with that of either condenser.

In Fig. 2, C is a parallel-plate condenser having two plates, each of area 10 sq. cm., separated by a ceramic material of thickness 0·1 mm., and dielectric constant 1,200; R is a 10 megohm resistance, and the battery has a constant e.m.f. of 60 volts. At a certain instant after the switch S has been closed, the micro-ammeter M registers $3{\cdot}2 \times 10^{-6}$ amp. Find the potential difference between the plates of C, and the charge on each plate, at this instant.

[One farad is 9×10^{11} e.s.u. of capacity.]

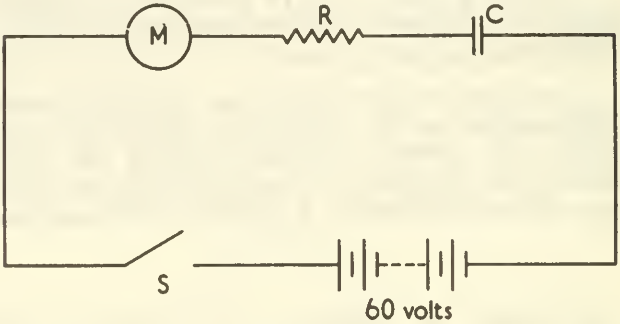


FIG. 2.

11. Define the *absolute electromagnetic unit of current*, and deduce an expression for the magnetic field-strength at the centre of a plane circular coil of n turns, of radius r cm., carrying a current I e.m.u.

Explain how this result has been applied to the measurement of current.

A plane circular coil A, with 500 turns of radius 30 cm., is set with its plane in the magnetic meridian; at the centre of A, a small plane coil B with 100 turns, each of area 5 sq. cm., is pivoted about a horizontal axis lying in the meridian. A current of 1 amp. passes through the two coils in series. Calculate the moment of the couple which must be applied to the coil B in order to keep the plane of its windings horizontal.

12. Define *electromotive force*. Explain what is meant by the 'back e.m.f.' of a water voltameter.

Describe the lead accumulator, and discuss its behaviour as a system for the storing and release of energy.

A 60 ampere-hour accumulator of negligible internal resistance is connected in series with a 7·3 ohm resistance and fully charged at 5·0 amp. from a 50-volt supply. It is discharged at 12 volts through two 4-ohm lamps in parallel, the connecting wires to each lamp being of 0·1 ohm resistance. Find the energy supplied to the battery, and the energy dissipated in the lamps.

A 21/II

OXFORD LOCAL EXAMINATIONS
GENERAL CERTIFICATE OF EDUCATION
Summer Examination, 1958
Advanced and Scholarship Level
PHYSICS, PAPER II

TUESDAY, JULY 1. TIME ALLOWED—3 HOURS

[Write the number of the paper, A 21/II, on the left at the head of each sheet of your answers in the space provided.

Answer SIX questions only, including at least ONE question from each of the four sections of the paper.

Mathematical tables and squared paper are provided.]

[Take g to be 981 cm./sec.^{2}]

SECTION A

1. Find an expression for the work done in stretching an elastic wire in terms of the stress, the strain, and the dimensions of the wire.

Describe the experiment you would perform to determine Young's modulus for a material supplied in the form of a wire.

For steel, the coefficient of linear expansion is $1{\cdot}2 \times 10^{-5}$ per C. degree, and Young's modulus is 2×10^{12} dynes/sq. cm. What load attached to a steel wire of diameter 0·6 mm., hanging vertically, will produce the same extension as would a temperature rise of 15 Centigrade degrees ?

2. Describe the Weston differential pulley system, and show how to calculate the velocity ratio. How would you measure the efficiency experimentally for a given load ? Why would you expect the efficiency to depend on the magnitude of the load ?

The diameters of the two upper pulleys of such a system are 8 in. and 10 in. respectively, and the mass of the lower pulley block is 4 lb. A load of 30 lb. wt. is raised by an effort of 8 lb. wt. Regarding the frictional resistance as being equivalent to an additional load to be raised, calculate its value. Find also the force that must be applied to the appropriate side of the chain in order to lower the load. [You may neglect the mass of the chain.]

3. Show that a particle of mass m describing a circular path of radius r with uniform angular velocity ω experiences a force $mr\omega^2$ towards the centre of the circle.

Why does a passenger in a car which is turning a corner feel a tendency to move away from the centre of the curve?

The period of a simple pendulum, when it is making small oscillations in one plane, is 1·50 sec. Find the period of angular rotation when it swings as a conical pendulum, so that the bob describes a horizontal circle of radius 20 cm.

SECTION B

4. Define *coefficient of thermal conductivity.* Describe how you would measure the thermal conductivity of a bad conductor. (A method such as would be used in a school laboratory is expected, and you should point out the chief sources of error in this method.)

A pond is covered with a layer of ice 1·5 cm. thick, the air temperature above it is $-12°$ C., and the water below is at 0° C. Estimate the rate at which the thickness of the ice is increasing.

[Take the latent heat of fusion of ice to be 80 cal./gm., its density to be 0·91 gm./c.c., and its thermal conductivity to be 0·005 cal. $(\text{sec.})^{-1}(°\text{C.})^{-1}(\text{cm.})^{-1}$.]

5. Discuss the law of conservation of energy from the point of view of the interrelation of heat and mechanical energy, and describe an experimental method of determining the mechanical equivalent of heat.

Calculate a value for J from the following data:

specific heat of argon at constant volume $= 0·073$ cal. $(\text{gm.})^{-1}(°\text{C.})^{-1}$;

number of molecules in 1 gm. of argon $= 1·5 \times 10^{22}$;

average kinetic energy of a molecule at $T°$ absolute is $\frac{3}{2}\,kT$, where $k = 1·38 \times 10^{-16}$ ergs/degree.

6. Explain what is meant by a longitudinal progressive wave. What are the chief reasons for believing that sound is propagated as a wave motion of this kind?

Describe how Kundt's tube may be used to find the velocity of sound in a wooden rod, it being assumed that the value for the velocity in air is already known.

A wooden rod, clamped at its mid-point, gives a fundamental note of frequency 2,500 cycles/sec. Calculate the length of the rod, given that Young's modulus for wood is $1{\cdot}4 \times 10^{11}$ dynes/sq. cm. and its density is 0·7 gm./c.c.

SECTION C

7. Describe an experimental method for determining the velocity of light.

Describe, and give brief explanations of, simple observations which show (*a*) that light waves travel more slowly in glass than in air, and (*b*) that blue light travels more slowly in glass than red light does.

8. Describe, with full experimental details, an optical method for determining the radius of curvature of a convex mirror. Obtain the formula relating the radius of curvature of such a mirror with the distances from the mirror of a small object and its image.

A **concave** mirror, of 60 cm. radius of curvature, lies with its axis vertical at the bottom of a beaker and is covered with a 10 cm. layer of water. A small object is held on the axis, 6 cm. above the surface of the water. Find (*a*) the position, with respect to the pole of the mirror, of the image formed by reflection in the mirror; and (*b*) the apparent position of this image, with respect to the water surface, as seen from above.

[Take the refractive index of water to be 4/3.]

9. Explain the conditions that must be fulfilled in order to produce an optical interference pattern.

Describe how you would set up a simple two-slit arrangement in order to demonstrate the phenomenon of interference. Draw diagrams showing the kind of pattern you would observe (*a*) in monochromatic light, and (*b*) in white light.

Find the distances between adjacent bright fringes in monochromatic light of wavelength $5{\cdot}5 \times 10^{-5}$ cm. when the pattern is observed at a distance of 120 cm. from the slits, which are 0·61 mm. apart.

SECTION D

10. Describe carefully the experiments you would perform with a deflexion magnetometer and a vibration magnetometer in order to measure the magnetic moment of a magnet and the value of the horizontal component of the earth's magnetic field.

[You are **not** required to deduce the formula for the field at a point on the axis of a bar magnet, which you may take, for the purpose of your discussion, to be $2M/d^3$ at distance d from a short magnet of moment M; neither are you expected to deduce the vibration formula from first principles. A concise account of the conduct of the experiment is wanted.]

A short bar magnet is laid horizontally in the magnetic meridian with its north-seeking pole pointing southwards. Neutral points are suspected to be somewhere in the region of $d = 40$ cm. and it is proposed to locate the neutral points by finding the period of vibration T of a vibration magnetometer for values of d between about 20 cm. and 60 cm., and plotting an appropriate linear graph. State what quantities you would plot against one another and draw a sketch of the kind of graph you would expect to obtain.

11. Describe and give the theory of a simple form of alternator for producing single-phase alternating e.m.f.

Distinguish between the peak value and the root-mean-square value of the e.m.f., and show how they are related.

Explain (*a*) why the current in an inductance of negligible resistance lags behind the applied voltage by a quarter of a period, and (*b*) why the average power dissipation in such an inductance is zero.

12. Give an account of the structure and behaviour of a thermionic diode. What are the chief points of resemblance between a thermionic diode and a modern form of X-ray tube?

Describe any one application of the diode.

A 21/III

OXFORD LOCAL EXAMINATIONS

GENERAL CERTIFICATE OF EDUCATION

Summer Examination, 1958

Advanced and Scholarship Level

PHYSICS, PAPER III

WEDNESDAY, JULY 2. TIME ALLOWED—3 HOURS

[Write the number of the paper, A 21/III, on the left at the head of each sheet of your answers in the space provided.

You will have THREE questions allotted to you, and you will be required to attempt TWO of these and TWO only. Every observation should be recorded as it is made, on a sheet of paper which is to be handed in to the Examiner. At the end of each experiment a description of the method used should be given, together with a diagram of the apparatus. In all experiments an estimate should be given of the accuracy which is expected in the result. You are not required to prove any standard formula, but should indicate clearly how the necessary calculations and deductions have been made.

Mathematical Tables, and Squared Paper as necessary, are provided.]

1. Find experimentally the position of the centre of gravity of the given cardboard sheet. Suspend it and allow it to oscillate as a compound pendulum about a horizontal axis passing, in turn, through each of the six holes drilled along a diagonal of the sheet. Measure, in each case, the period of oscillation T and the distance h of the axis from the centre of gravity of the sheet.

Plot a graph of T^2h against h^2 and, taking the formula relating T and h to be

$$T = 2\pi\sqrt{\left(\frac{k^2+h^2}{hg}\right)},$$

find the values of the constants k and g.

2. Plot a load-extension graph for the given spiral spring.

Using this as a spring balance, determine the specific gravity of the solid *A*, and also the specific gravity of the liquid *B*.

3. Determine the thermal capacity of the given piece of metal *M*.

Then use this to find the boiling-point of the liquid *B* by a calorimetric method. Due allowance should be made for loss of heat to the surroundings. (The piece of metal must be immersed in the liquid and not suspended in its vapour. Take the specific heat of copper to be 0·1.)

4. Determine the mean value of the apparent coefficient of expansion of water in glass

(*a*) between air temperature and about 50° C.;

(*b*) between this last temperature and about 80° C.

Remember that the liquid filling the bottle at the end of stage (*a*) is that required for the start of stage (*b*), so that the only additional weighing required for (*b*) is that for the final temperature.

5. With the apparatus provided, determine a value for the mechanical equivalent of heat. You are to use paraffin oil, of specific heat 0·53, in the calorimeter. Due allowance should be made for loss of heat to the surroundings. You will be told the water equivalent of the calorimeter.

6. Find the distance, *L*, of the first resonance position from the open end of the tube for each of the forks of given frequencies *f* provided.

Plot a graph of $1/f$ against *L*, and use it to determine the speed of sound and the end correction of the tube.

Record the temperature, and the internal diameter of the tube.

[In order to avoid difficulties which may arise from harmonics of the fork, you are reminded that for a middle *C* fork the resonance required is that which will give a value of about 30 cm. for *L*.]

7. For different values of the object distance u, measure the distance D between object and real image for the given convex lens.

Plot a graph of D against u, and from it determine the focal length of the lens.

8. For the loop of resistance wire provided, measure the resistance R between the fixed contact O and successive bared points which are at distances, l, of 50 cm., 100 cm., 150 cm., and 200 cm. from the same end of O. You should make contact at each of these places by means of a crocodile clip.

Plot a graph of R/l against l; and, assuming the relation $R = Al - Bl^2$, find the values of A and B.

9. Set the plane of the tangent galvanometer in the magnetic meridian, and lay the metre rule horizontally at right angles to the meridian and level with the galvanometer needle.

Pass a current I_0 through the coil, so as to give a deflexion between 30° and 60°, with the given magnet well out of the way. You should use the number of turns which will make I_0 **about** 1 amp. Record this initial deflexion, θ_0. Now increase the current to some value I, **about** 1·2 amp. Lay the magnet on the metre rule with its axis at right angles to the plane of the coil and its field opposing the coil's field. Move the magnet along the rule until the galvanometer deflexion is reduced to the original value θ_0, and when this happens measure the distance d of the centre of the magnet from the centre of the coil. Take five more readings, increasing I first, and then bringing the magnet nearer so as to regain the original deflexion θ_0.

Plot a graph of $(I - I_0)$ against $1/d^3$, and state the conclusion to be drawn from this graph.

Read these instructions carefully, and follow them closely; it is **not** *necessary, or possible, to reverse the current through the coil at any stage, as you are asked to work with the magnet on one side of the coil, pointing in one set direction only.*

A 21/IV

OXFORD LOCAL EXAMINATIONS

GENERAL CERTIFICATE OF EDUCATION

Summer Examination, 1958

Scholarship Level

PHYSICS, PAPER IV

FRIDAY, JULY 11. TIME ALLOWED—3 HOURS

[Write the number of the paper, A 21/IV, on the left at the head of each sheet of your answers in the space provided.

This paper is to be taken only by candidates at Scholarship Level.

Attempt SIX questions only, including at least ONE question from each of the four sections of the paper.

Mathematical tables are provided.]

[Take g to be 981 cm./sec.^{2}]

SECTION A

1. Obtain from first principles an expression for the period of a compound pendulum executing small oscillations in a vertical plane under gravity, and describe how you would use some form of compound pendulum to determine the value of g.

Show that, with a modern apparatus capable of detecting small differences in g of the order of one part in a million, it should be possible to detect a mineral deposit in the form of a spherical mass of radius 100 metres, with centre 150 metres below the surface of the earth, if the mineral differs in density from the surrounding material by 1 gm./c.c.

[Take the value of the gravitational constant, G, to be $6{\cdot}7 \times 10^{-8}$ c.g.s. units.]

2. State the assumptions that are made in applying the kinetic theory to calculate the pressure of an ideal gas, and show that, at constant temperature, the pressure of an ideal gas is directly proportional to its density.

Assuming that the temperature of the atmosphere does not vary with the height, obtain a formula for the dependence of the barometric pressure on altitude. If the pressure is 76 cm. of mercury at ground level, and 70 cm. of mercury at a height of 800 metres, estimate the pressure at 12,000 metres.

3. Define *coefficient of viscosity.* Derive, by the method of dimensions, the form of the Poiseuille formula for the flow of a liquid through a capillary tube.

Describe how you would apply the Poiseuille formula to determine the viscosity of water. How would you satisfy yourself that laminar-flow conditions had obtained during the experiment?

SECTION B

4. Explain what is meant by a perfectly black body. How does the radiation from a black body depend upon its temperature? How is it possible to obtain in practice a close approximation to a black body?

Assuming that the human body has an effective surface area of 2 sq. metres, and that it radiates as a black body at 35° C., find in watts the net rate of loss of energy by radiation when the surroundings are at 15° C.

[Take Stefan's constant to be

$5{\cdot}7 \times 10^{-5}$ ergs $(\text{cm.})^{-2}(\text{sec.})^{-1}(°\text{ C.})^{-4}$]

5. Write an essay on the liquefaction of air.

6. Give an account of the Doppler effect in sound, distinguishing between the cases of (*a*) moving source and stationary observer, and (*b*) moving observer and stationary source.

Consider also the cases when (i) source and observer are moving with the same velocity in the same straight line, and (ii) the source approaches, and recedes from, a stationary observer with a velocity greater than that of sound.

SECTION C

7. Explain the terms *spherical aberration*, *chromatic aberration.* Outline the methods which are adopted to minimize these defects when using lenses.

To what extent is the mere reduction of the aperture of a lens a satisfactory expedient for counteracting aberrations?

A telephoto lens consists of a thin convex lens *A* of focal length 15 cm., and a thin concave lens *B* of focal length 10 cm., arranged coaxially at a distance apart of 6 cm., with *A* facing the incident light. Find the distance from *A* at which the system forms an image of a distant object, and how many times longer this image is than the image which would have been formed with *A* alone.

8. Prove that the deviation undergone by a ray of light passing through a principal section of a triangular prism is a minimum when the angles of incidence and emergence are equal.

Describe how you would use the method of minimum deviation to determine the refractive index of the material of a prism for monochromatic light.

Discuss the accuracy that might reasonably be expected of the result of such an experiment.

9. What is meant by diffraction? Illustrate your answer by discussing the behaviour of light beams emerging from (*a*) a narrow slit, and (*b*) an extended aperture.

Explain the action of the diffraction grating. What factors determine the number of orders visible?

In a certain experiment using normal incidence, the readings for the angle of diffraction in the second order spectrum for the two sodium *D* lines were: D_1, 42° 8′; D_2, 42° 5′. If the wavelength of the D_1 line is 5896 A.U., find the number of lines per centimetre of the grating, and the wavelength of the D_2 line.

SECTION D

10. Describe any one accurate method for the measurement of electrical resistance. Point out the merits and defects of the method you describe.

Discuss the variation of resistivity with temperature in the cases of (*a*) pure metals, (*b*) electrolytes.

11. What are your reasons for believing that all electric charges are multiples of a fundamental unit, the electronic charge e?

Describe an experiment by which the value of e/m for the electron has been determined.

In the cyclotron, positively charged particles, each having a given constant charge e and a given constant mass m, move through a magnetic field H, which is directed at right angles to the plane of the figure and down into the paper. The particles are accelerated by an alternating electrical potential difference V between X and Y, directed as XY when a particle is at x, and as YX when the particle has reached y. Assuming that the separation of the hollow evacuated conductors X is small, prove—

(*a*) that each path described in X or Y is part of a circle;

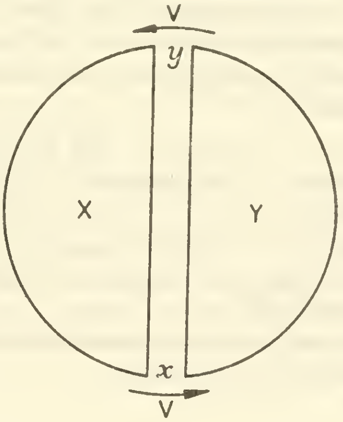
(*b*) that the radius of the circle increases as the velocity of the particle increases;

(*c*) that the time taken for each excursion in X or Y is the same;

(*d*) that the radii ρ_1 and ρ_2 of the circles described in successive paths on the same side of the gap between the conductors are related by the formula

$$\rho_2^2-\rho_1^2=4mV/H^2e.$$

[Assume that e, V, and H are all measured in the absolute c.g.s. system of electrical units.]



12. Define the terms *induction* (or *flux-density*) B, and *intensity of magnetization* I, and show how they are related for a material of permeability μ.

Describe how you would determine experimentally the form of the magnetization cycle curve for a ferromagnetic material, and discuss the information obtainable from such a curve.

A 22/I

OXFORD LOCAL EXAMINATIONS

GENERAL CERTIFICATE OF EDUCATION

Summer Examination, 1958

Advanced and Scholarship Level

CHEMISTRY, PAPER I

WEDNESDAY, JUNE 25. TIME ALLOWED—3 HOURS

[Write the number of the paper, A 22/I, on the left at the head of each sheet of your answers in the space provided.

Answer SIX questions, including not more than THREE from Section A and not more than TWO from each of the Sections B and C.

Mathematical tables are provided.]

SECTION A

1. Give an account of the operation and functions, in the Lead Chamber process for making sulphuric acid, of (*a*) the Glover tower; (*b*) the chambers; (*c*) the Gay Lussac tower. Explain how the catalyst lost in the process is replaced and how the acid is formed in the chambers.

What is superphosphate and how is it made? State **four** other large scale uses of sulphuric acid.

How would you identify an insoluble sulphate, e.g. barium sulphate?

2. State how (*a*) ammonia, and (*b*) phosphine are usually prepared in the laboratory. Write equations for the reactions.

Compare (i) the effect of heating ammonia and phosphine, (ii) their reactions (if any) with (1) water, (2) hydrogen chloride.

Describe **one** method of establishing the formula of **either** ammonia **or** phosphine.

3. What are the chief reactions which occur in the blast furnace in the extraction of iron?

What is steel? Outline **one** process for making steel.

Describe briefly how you would prepare from iron (*a*) hydrated ferrous chloride; (*b*) anhydrous ferric chloride; (*c*) potassium ferrocyanide.

4. 3·5 gm. of a metallic chloride were dissolved in distilled water and the solution made up to 250 ml. 25 ml. of this solution were equivalent to 29·25 ml. of 0·098 N silver nitrate solution. Calculate the percentage of chlorine in the chloride, and state how the titration with the silver nitrate would be carried out.

Briefly describe how you would estimate the percentage of (*a*) barium, (*b*) water of crystallization in hydrated barium chloride.

[Cl = 35·5.]

SECTION B

5. If provided with 0·5 N solutions of potassium hydroxide and nitric acid, describe how you would determine the quantity of heat evolved when one gram-equivalent of the acid and of the alkali react. State, with reasons, the results you would expect to obtain using other strong acids and strong alkalis.

Define the term *heat of combustion,* and briefly describe how it has been determined in the case of a substance like carbon.

The heats of combustion of carbon, sulphur, and carbon disulphide are respectively 97, 71, and 265 Cals. Calculate the heat of formation of carbon disulphide.

6. 0·665 gm. of camphor dissolved in 14·56 gm. of benzene gave a freezing-point depression of 1·61° C. The depression constant for 1,000 gm. benzene is 5°.

From first principles, calculate the molecular weight of camphor.

Given a correctly set thermometer, describe exactly how you would measure the freezing-point of the benzene and of the solution in an experiment of the above type. Draw a diagram of the essential apparatus.

The freezing-points of benzene and of a solution containing 0·6 gm. of acetic acid in 100 gm. of benzene are respectively 5·4 and 5·15° C. What do you conclude from these data?

[H = 1; C = 12; O = 16.]

7. Explain fully the meaning of the following terms: (*a*) balanced reaction; (*b*) equilibrium constant; (*c*) degree of ionization; (*d*) weak electrolyte; (*e*) dissociation constant; (*f*) dialysis.

SECTION C

8. Describe the preparation and collection of a few jars of acetylene free from phosphine and hydrogen sulphide. How is acetylene stored in steel cylinders? Explain why this method is adopted.

What are the reactions of acetylene with (*a*) chlorine, (*b*) ammoniacal cuprous chloride, (*c*) alkaline potassium permanganate?

How is acetylene converted into acetic acid?

9. Starting with ethyl benzoate indicate how you could obtain specimens of (*a*) **pure** ethyl alcohol, (*b*) benzoic acid, (*c*) diethyl ether.

Write the structural formulae of (i) methyl acetate, (ii) ethyl formate. Briefly describe how ethyl formate is prepared.

10. How, and under what conditions, does an alkyl bromide react with (*a*) potassium hydroxide; (*b*) ammonia; (*c*) sodium and ethyl bromide; (*d*) sodium ethoxide? Compare the reactions, if any, of bromobenzene with these substances.

State how (i) propionic acid, (ii) normal propylamine can be obtained from ethyl bromide.

A 22/II

OXFORD LOCAL EXAMINATIONS
GENERAL CERTIFICATE OF EDUCATION
Summer Examination, 1958
Advanced and Scholarship Level
CHEMISTRY, PAPER II

FRIDAY, JUNE 27. TIME ALLOWED—3 HOURS

[Write the number of the paper, A 22/II, on the left at the head of each sheet of your answers in the space provided.

Answer SIX questions, including not more than THREE from Section A and not more than TWO from each of the Sections B and C.

Mathematical tables are provided.]

SECTION A

1. Describe the extraction of bromine from sea-water, and give **three** industrial uses of bromine.

How, and under what conditions, does bromine react with (*a*) hydrogen; (*b*) hydrogen sulphide; (*c*) potassium iodide; (*d*) potassium hydroxide? Indicate how you would distinguish between bromine and chromyl chloride.

2. Give an account of the production of (*a*) amorphous silicon; (*b*) carborundum; (*c*) silica gel; (*d*) soda-glass. What do you know of the uses of (*b*), (*c*), and sodium aluminium silicate?

3. Describe the production of (*a*) sodium hydroxide from sodium carbonate, (*b*) metallic sodium from **either** sodium chloride **or** from sodium hydroxide.

How is sodium converted into (i) sodium peroxide, (ii) sodium cyanide, and what are the uses of these compounds?

What are the differences in properties between (1) sodium and potassium carbonates, (2) sodium and potassium bicarbonates, and (3) sodium and potassium sulphates?

4. What is the chief ore of tin and how is the metal obtained from it? For what purposes is tin used?

How, and under what conditions, does tin react with (*a*) nitric acid, (*b*) chlorine, (*c*) potassium hydroxide?

State what is seen when stannous chloride solution reacts with (i) mercuric chloride solution, (ii) hydrogen sulphide. Write equations for the reactions which occur. How does the precipitate obtained in (ii) react with yellow ammonium sulphide?

Section B

5. Explain clearly what you understand by the terms (*a*) osmosis, (*b*) semi-permeable membrane, (*c*) osmotic pressure.

State how osmotic pressure, for solutions of non-electrolytes, is related to (i) the concentration of the solute, (ii) the temperature. What deduction was made by van't Hoff from these relationships, and what is its importance?

The vapour pressures of an aqueous solution of urea and of water at the same temperature are respectively 740 and 750 mm. Calculate the weight of urea dissolved in 100 gm. of water, if the molecular weight of urea is 60.

6. State and explain what happens when

(*a*) rhombic sulphur is heated to 100° C.;

(*b*) white phosphorus is heated in nitrogen to 200° C.;

(*c*) a little red phosphorus is heated strongly in a narrow glass tube, sealed at one end;

(*d*) liquid mercuric iodide is cooled to room temperature.

What is the arrangement of the carbon atoms in graphite and in diamond?

7. Explain the following:

(*a*) Addition of ammonium chloride to a solution of ammonium hydroxide changes the hydroxyl-ion concentration.

(*b*) Hydrogen sulphide when passed into a solution of zinc sulphate containing dilute sulphuric acid gives no precipitate, but addition of sodium acetate solution then produces a white precipitate.

(*c*) Addition of sodium carbonate to a solution of phenolphthalein gives a red solution.

(*d*) Sheet iron coated with tin, if scratched and exposed to damp air, rusts readily.

SECTION C

8. What do you understand by the terms *nitration* and *sulphonation* ?

Describe the preparation of pure specimens of (*a*) *m*-dinitrobenzene from nitrobenzene, (*b*) sodium benzenesulphonate from benzene.

How would you detect (i) nitrogen in *m*-dinitrobenzene, (ii) sulphur in sodium benzenesulphonate? Give the reactions which occur in (i).

9. Distinguish between the radicals acetyl, benzyl, and benzoyl.

Describe how acetyl chloride is prepared, and give its physical properties.

State how acetyl chloride reacts with (*a*) an alcohol, (*b*) a primary amine, and give **one** actual example in each case. How is acetic anhydride obtained from acetyl chloride ?

10. (*a*) Deduce the molecular formula and write the structural formulae of the isomeric saturated aliphatic alcohols which contain 60 per cent. of carbon, and give their names.

What substances are formed when these alcohols are oxidized with acidified dichromate ? Give their structural formulae.

(*b*) The vapour density of the diethyl ester of a dicarboxylic acid is 73. What is the structural formula of the ester, and how does it react with 0·880 ammonia ?

(*c*) 20 ml. of a solution of urea with excess alkaline sodium hypobromite solution gave 448 ml. of nitrogen at S.T.P. Calculate the weight of urea in 100 ml. of the solution.

[$H = 1$; $C = 12$; $N = 14$; $O = 16$; 1 gram-mol. of nitrogen at S.T.P. occupies 22·4 litres.]

A 22/III

OXFORD LOCAL EXAMINATIONS

GENERAL CERTIFICATE OF EDUCATION

Summer Examination, 1958

Advanced and Scholarship Level

CHEMISTRY, PAPER III

MONDAY, JULY 7. TIME ALLOWED—3 HOURS

[Write the number of the paper, A 22/III, on the left at the head of each sheet of your answers in the space provided.

Answer ALL THREE QUESTIONS.

The answer to Question 1 should consist of a brief statement of procedure, actual measurements, calculations, and results.

Mathematical tables are provided.]

1. Determine the percentage of ferrous ammonium sulphate, $(NH_4)_2Fe(SO_4)_2 . 6H_2O$, in the mixture **A.**

Weigh accurately not more than 10 gm. of **A.** Transfer the solid to a 250 ml. flask containing about 50 ml. of dilute sulphuric acid, dissolve the solid and make the solution up to 250 ml. with distilled water.

Titrate 25 ml. portions of your solution of **A** with solution **B,** which contains 3 gm. of potassium permanganate per litre.

[N = 14; O = 16; S = 32; K = 39; Mn = 55; Fe = 56.]

2. Analyse **C** which is a mixture of two metals.

3. The substance **D** has the formula $RM(SO_4)_2 . 12H_2O$. Perform the following experiments and record your observations. From these experiments only, identify the radicals **R** and **M**, and explain the reactions which occur.

(*a*) Make a solution of **D** in distilled water, then add dilute sulphuric acid until there is no further colour change. Divide this solution into two portions. (i) Pass hydrogen sulphide through one portion until nothing further happens, then add ammonium hydroxide solution until the liquid is alkaline. (ii) To the second portion add some freshly made potassium ferricyanide solution, then a little stannous chloride solution.

(*b*) Make a solution of a small quantity of **D** in distilled water in a boiling-tube, add sodium hydroxide solution in excess and boil the mixture.

A 22/IV

OXFORD LOCAL EXAMINATIONS

GENERAL CERTIFICATE OF EDUCATION

Summer Examination, 1958

Scholarship Level

CHEMISTRY, PAPER IV

TUESDAY, JULY 8. TIME ALLOWED—3 HOURS

[Write the number of the paper, A 22/IV, on the left at the head of each sheet of your answers in the space provided.

Answer FIVE questions, selecting not more than TWO from any ONE section.

Mathematical tables are provided.]

SECTION A

1. Give an account of some important chemical processes in which high pressures are employed.

2. What do you know of the discovery, manufacture, properties, and uses of fluorine? Discuss the chemical differences between fluorine and chlorine.

3. Compare and contrast the chemistry of the elements magnesium, zinc and mercury, and of their commoner compounds.

SECTION B

4. Write an essay on isotopes.

5. Describe how the absolute density of any one gas has been determined with great accuracy, and give an account of important discoveries which were a sequel to determinations of this type.

6. What is a complex ion, and what do you know of methods which have been used to indicate the presence of complex ions in solution?

Explain how the formation of complex ions is used in the detection of certain metals in qualitative analysis.

SECTION C

7. What are the chemical differences between the two substances in each of the following pairs of compounds: (*a*) methyl alcohol and ethyl alcohol; (*b*) formic acid and acetic acid; (*c*) acetaldehyde and benzaldehyde; (*d*) ethylamine and aniline; (*e*) chloroform and carbon tetrachloride?

8. Explain the following terms: polarized light; optically active compound; asymmetric carbon atom; stereoisomerism.

Give an example of an optically active alcohol and indicate how **either** this alcohol **or** lactic acid can be synthesized.

Describe **one** method of separating the isomers of an optically active acid.

9. An organic compound **A** contains 23·7 per cent. of nitrogen. **A** when refluxed with sodium hydroxide solution yields ammonia, and it also reacts with nitrous acid giving nitrogen. Distillation of a mixture of **A** with phosphorus pentoxide gives a compound **B,** which is composed of carbon, hydrogen, and nitrogen, the percentage of nitrogen being 34·14. Calculate the weight of **B** which contains 14 gm. of nitrogen. Thus identify **B** and **A,** and account for the above reactions.

Describe the reactions by which you could obtain an inflammable, gaseous, organic nitrogen compound from **A.**

Annex 2

MANCHESTER SECONDARY SCHOOL TEST PAPERS

The Secondary Modern School is for the two-thirds of children whose intelligence falls roughly within IQ 105–109 and IQ 80. About 30 percent have *higher* intelligence and enter selective secondary schools—the Grammar or the Technical Schools. Children with *lower* intelligence—below IQ 80—enter special schools for the "educationally subnormal" or ESN.

The five samples of schoolwork here given range from work done by Secondary Modern School pupils in the school's top ability "stream" to work done in its remedial groups in the bottom ability "stream".

For information on the scholastic attainments of Grammar and Technical School pupils consult Annex 1, containing samples of the General Certificate of Education (GCE) examinations for which these selective secondary schools prepare their students.

SAMPLE 1

Manchester Secondary Modern School—Top Ability "Stream"

Pupil age 14; finishing fourth form (tenth school year)

Geography test: Part of City of Manchester Secondary Modern School Leaving Examination. (Scholastically about the level of the New National Secondary Modern School Leaving Examination.)

List of books: Read by pupils who took the City of Manchester Secondary Modern School Leaving Examination (during their tenth school year).

NOTE.—Teachers feel the pupils whose examination papers are here given are capable of profiting from continuation of their schooling through the fifth form of the Secondary Modern School; and that they could obtain one to three "passes" in the GCE "ordinary level" examination.

Form 4U. Summer 196[illegible] Examination.

GEOGRAPHY

Answer all questions. Total marks 100.
Make sure that your name and form are on your answer sheet and your map.
Read the question through carefully and THINK before you write.

Question 1.

Account for the importance of an iron ens steel centre either in the British Isles or any European country you choose.
Draw a sketch map to show the position and extent of the area.
Briefly describe how iron and steel are produced.

Question 2.

With the aid of a sketch show the position and importance of Gibraltar.

Question 3.

One of man's greatest feats of engineering was the building of the Panama Canal. Account for the importance of this Canal, and the difficulties encountered when building it, and compare it with the Suez Canal.
A sketch would help your answer.

Question 4.

Name some world areas suitable for rice cultivation, say what the requirements are. What economic problems are found in these areas and what steps are being taken to overcome the problem ?

Question 5.

Homework.
World Map.

On the map provided write your name and form.
Mark in the following :-

a). a sea route London to Bombay via the Suez Canal.
b). a sea route London to New Zealand via the Panama Canal.
c). 2 trans-continental railway routes.
d). 2 coal producing countries (mark these by the letters CP on the map).
e). identify the towns marked A,B,C,D.

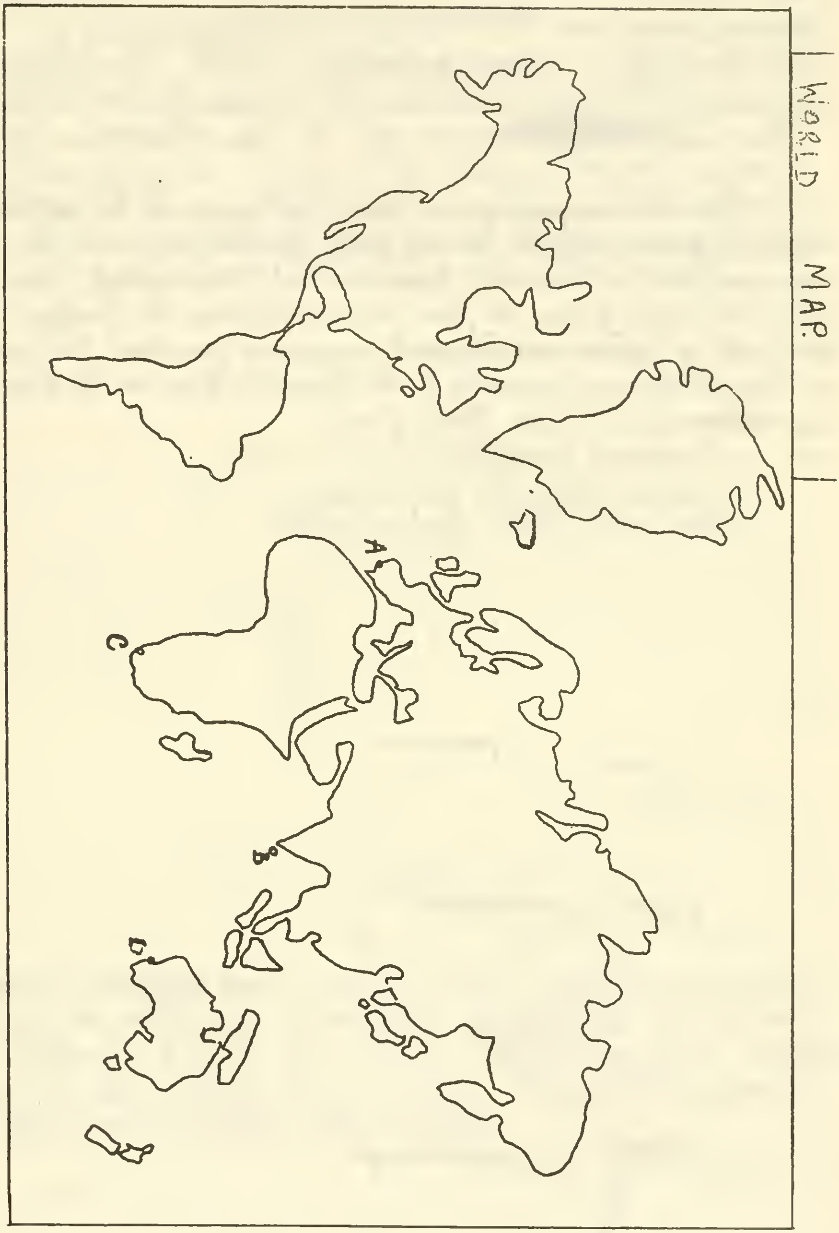
Conventional Signs.

On writing paper, draw sketches to show how the following symbols are illustrated on O.S. maps :-

a). Church with tower.
b). Multi-tracked railway showing a station.
c). A windmill.
d). 1st. class road crossing railway track.
e). Electric transmission.

NAME: ____________________

FORM ____________



CITY OF MANCHESTER EDUCATION COMMITTEE

Good pupil.
Deserves position in
G.C.E. class.

Examination Paper
(No. 3)

SUBJECT Geography

78 + 9 = (87)

School

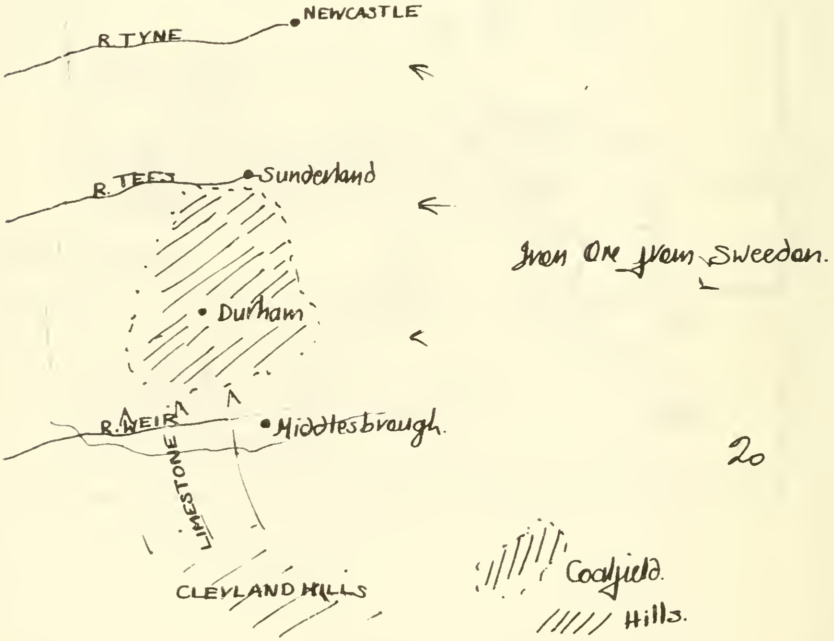
Standard 4u

Pupil's Name [redacted] 4u.

Date 4th July 1960

1. There is a very important Iron & steel centre on the Northumberland and Durham Coalfield. This was built up round tyneside. The three main ports are Newcastle, Sunderland and Middlesborough, these ports receive loads of Iron ore from Sweden and Spain. The Cleveland Hills south of Durham have adequate supplies of Limestone. The coal is transported by special siding to the furnaces. These are the three main reasons why it is so idealy placed.

1. Placed near A coalfield.
2. Supplies of Iron Ore from Sweden.
3. The Cleveland Hills supply Limestone.



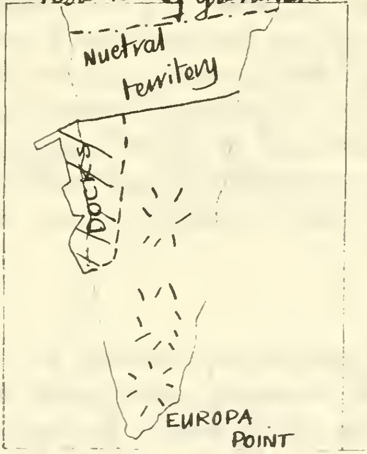
20

1.(Cont).

Quantities of Iron Ore, Coke, & Limestone are put into the Blast Furnace. The Coke builds the temperature up, then a jet of hot air melts the mixture. The Limestone extracts the slag (impurities in the mettle. With the Iron being heavier it sinks to the bottom, meanwhile the slag is then drawn of throught a seperate channel. The Iron is not yet pure, some carbon and other chemicals have to be added. When the Iron runs ~~it~~ into the chanels it sets in blocks, It is then Pig Iron. This process is called smelting.

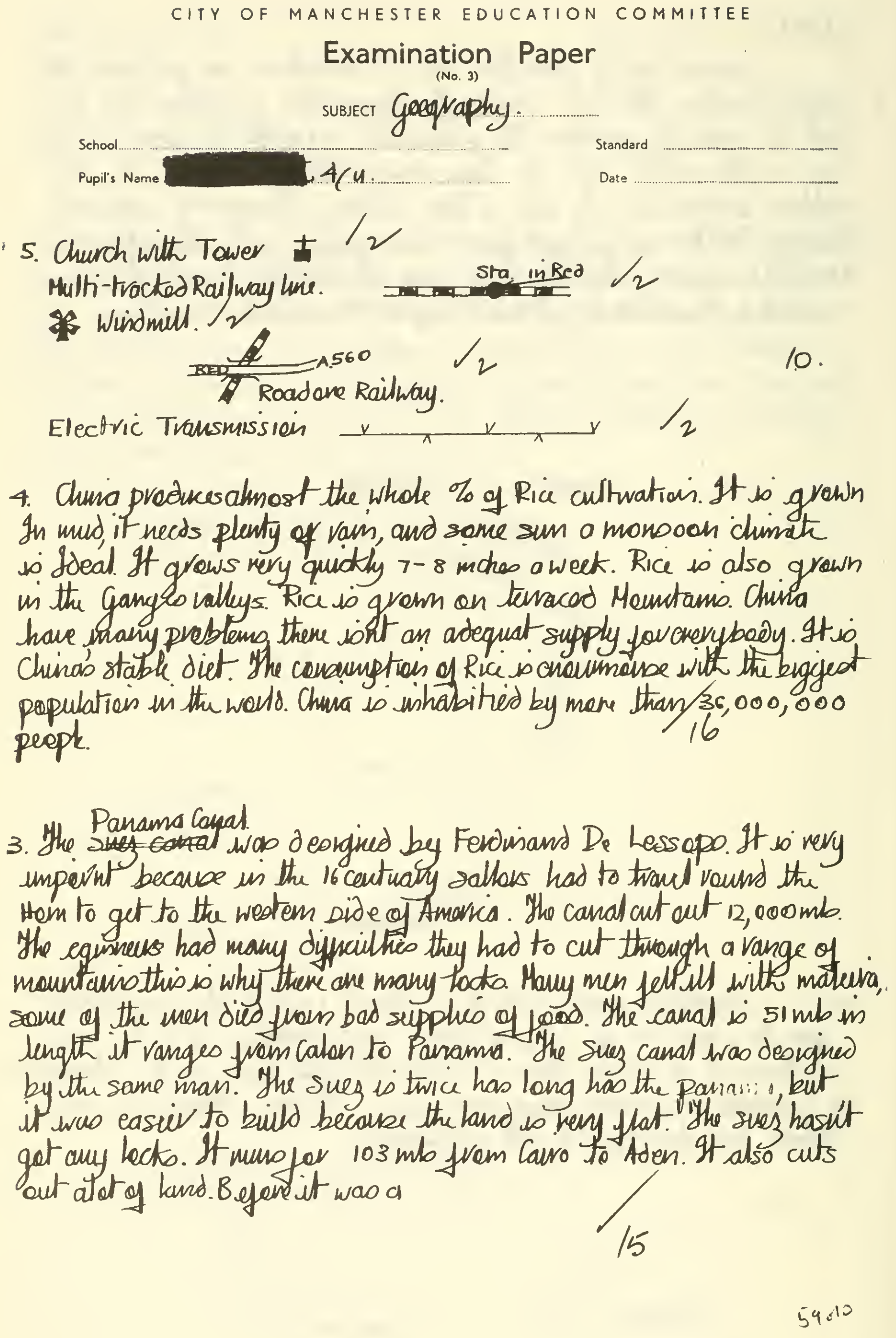
2.

Position of Gibraltar.



17

Gibraltar rises steadily to about 1,000 ft. It is important for the production of Cork, and fruits chiefly Oranges. It is the most southern part of Spain, there is a thin straight know as the straights of Gibralter seperating Spain from Africa. It has a Medditeranean climate hot and equable with cold winters.



CITY OF MANCHESTER EDUCATION COMMITTEE

Examination Paper
(No. 3)

SUBJECT Geography.

School .... Standard ....

Pupil's Name [redacted] 4(u. Date ....

5. Church with Tower ┼ /2
Multi-tracked Railway line. Sta. in Red /2
Windmill. /2
RED A560 /2
Road are Railway.
Electric Transmission /2

10.

4. China producesalmost the whole % of Rice cultivation. It is grown
In mud, it needs plenty of rain, and some sun a monsoon climate
is Ideal. It grows very quickly 7–8 inches a week. Rice is also grown
in the Ganges valleys. Rice is grown on terraced Mountains. China
have many problems there isn't an adequat supply for everybody. It is
China's stable diet. The consumption of Rice is enourmouse with the biggest
population in the world. China is inhabitied by more than 35,000,000
people.

16

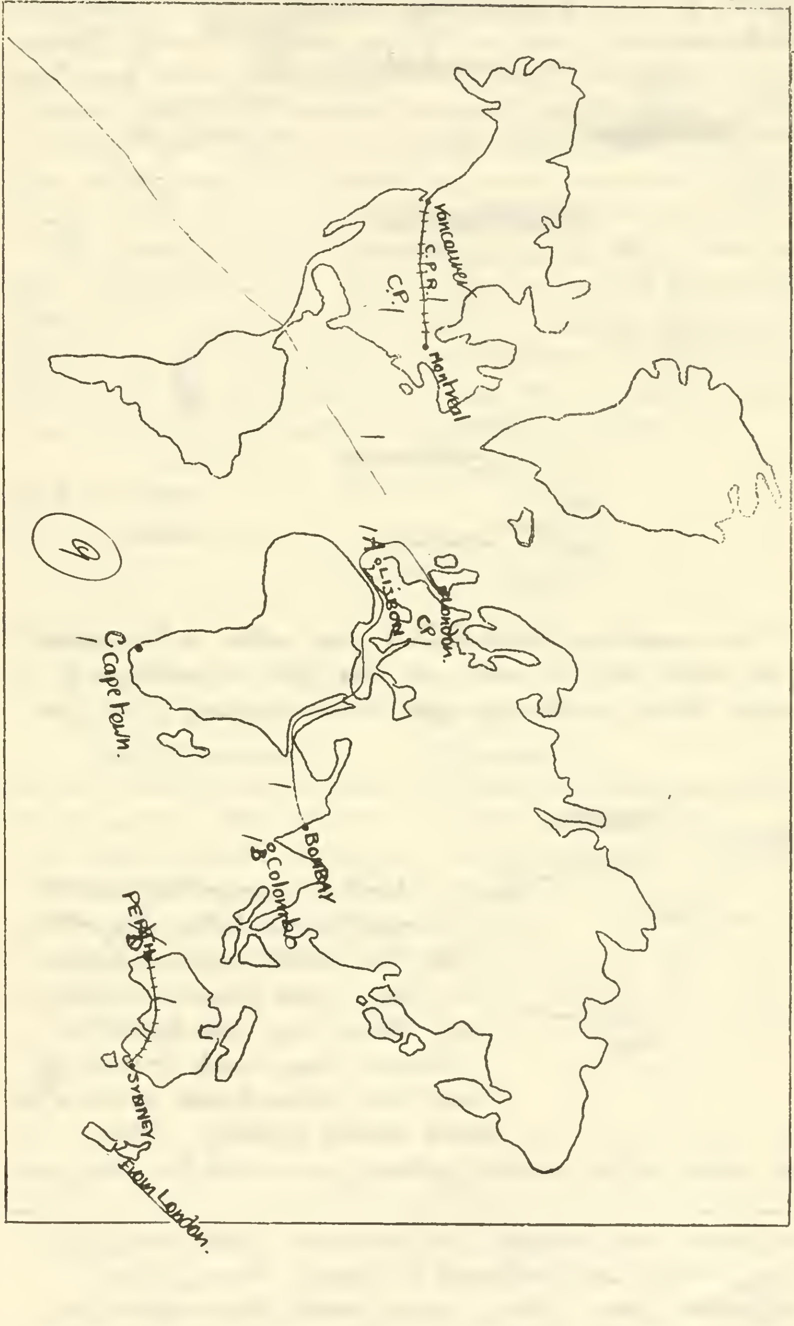
3. The ~~suez canal~~ Panama Canal. was designed by Ferdinand De Lessops. It is very
import because in the 16 centuary sailors had to travel round the
Horn to get to the western side of America. The canal cut out 12,000 mls.
The eginners had many difficulties they had to cut through a range of
mountains this is why there are many locks. Many men fell ill with materia,
some of the men died from bad supplies of food. The canal is 51 mls in
length it ranges from Colon to Panama. The Suez canal was designed
by the same man. The Suez is twice has long has the Panama, but
it was easier to build because the land is very flat. The suez hasn't
got any locks. It runs for 103 mls from Cairo to Aden. It also cuts
out alot of land. Before it was a

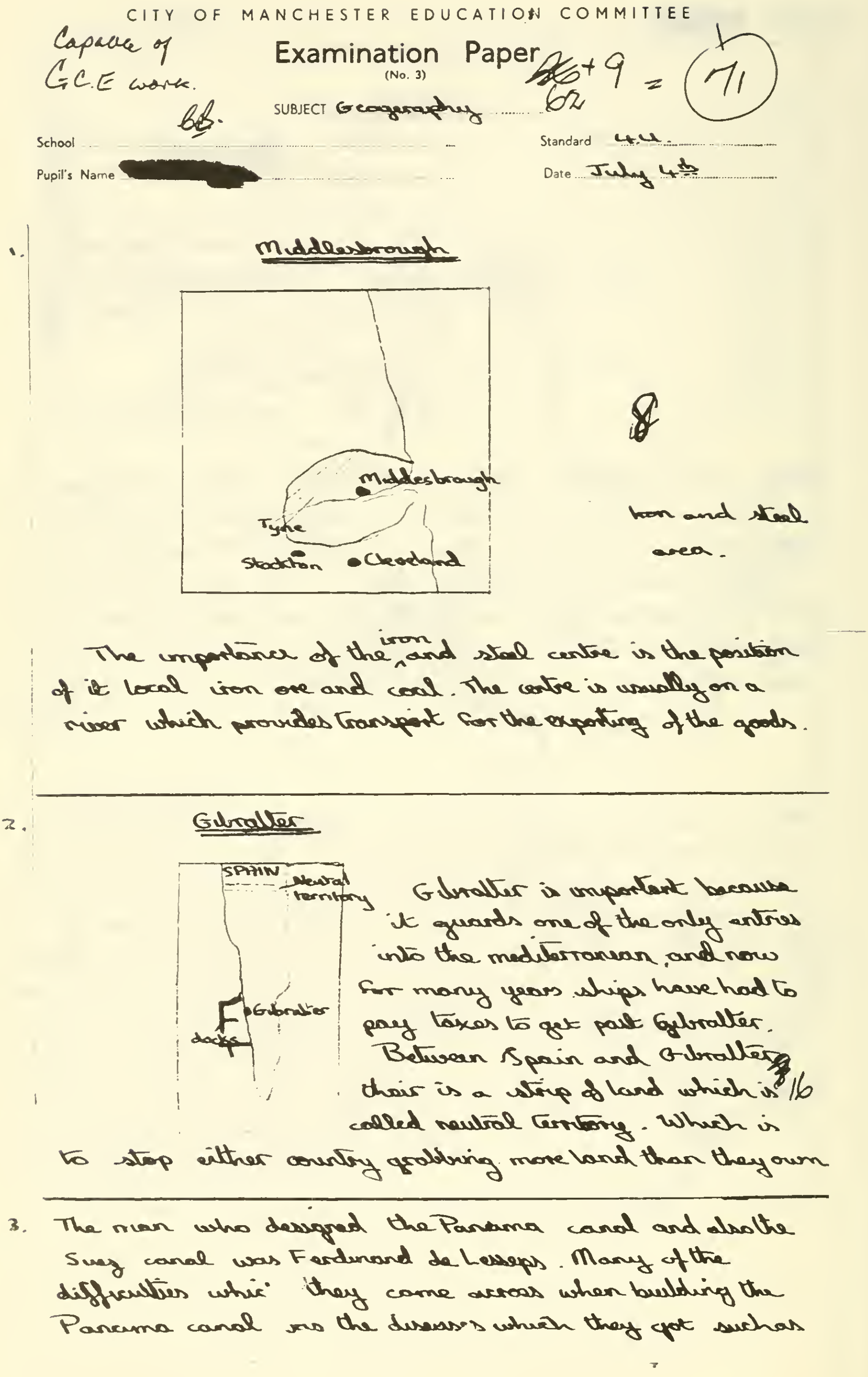
/15

54%

NAME: [redacted] FORM 4/II.

WORLD MAP





CITY OF MANCHESTER EDUCATION COMMITTEE

Capable of
G.C.E work.
bb.

Examination Paper
(No. 3)

~~56~~ + 9 = (71)
62

SUBJECT Geography

School

Standard 4 4.

Pupil's Name [redacted]

Date July 4th

1. Middlesbrough

Middlesbrough
Tyne
Stockton
Cleveland

8

Iron and steel area.

The importance of the iron and steel centre is the position of it local iron ore and coal. The centre is usually on a river which provides transport for the exporting of the goods.

2. Gibralter

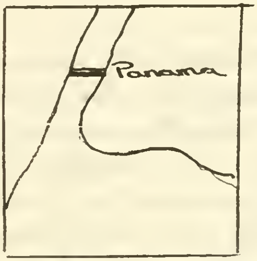
Gibralter is important because it guards one of the only entries into the mediterranean, and now for many years ships have had to pay taxes to get past Gybralter.
Between Spain and Gibralter their is a strip of land which is called neutral territory. Which is to stop either country grabbing more land than they own

16

3. The man who desigred the Panama canal and also the Suez canal was Ferdinand de Lesseps. Many of the difficulties whic they came across when building the Panama canal wo the diseases which they got such as

Malaria which killed off many of the workers. Another difficulty they came across was the building of so many locks to get over the high ground. So many men died when it was being made that they had to stop work. But a few years a later the American Government financed some money and work was started again the canal was finally finished in 1914. The canal was about forty-two miles long and had a depth from 45 to 85 ft.

The Suez canal is more than twice all as long as the Panama to be about right it is 103 miles long about 197 feet wide and has an average depth of about 33 feet. This canal was easier to build than the Panama because it was over flat country and so not many locks were needed to be built.



Panama canal

Suez canal

16

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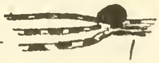
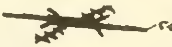
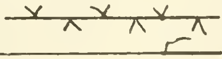
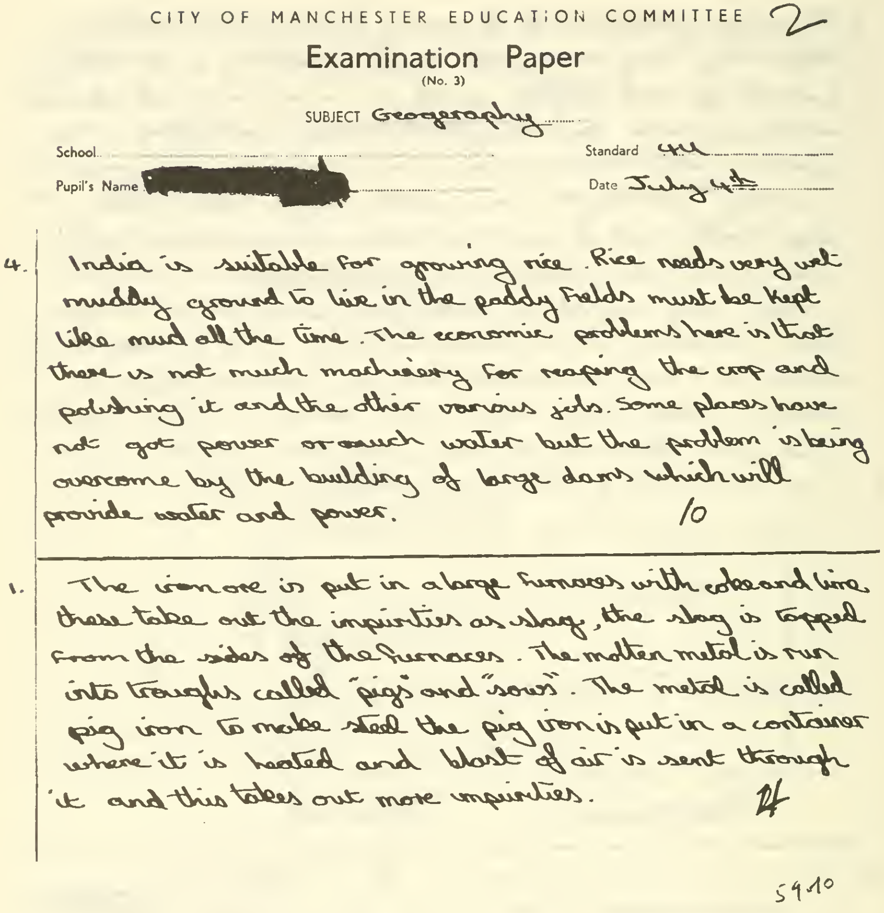
45. a. Church with tower √2
b. Multi-tracked railway showing a station  1
c. Windmill 2
d. 1st class road crossing railway track  red 1
e. Electric transmission  2 ⑧



CITY OF MANCHESTER EDUCATION COMMITTEE 2

Examination Paper

(No. 3)

SUBJECT Geography

School

Standard 4U

Pupil's Name [redacted]

Date July 4th

4. India is suitable for growing rice. Rice needs very wet muddy ground to live in the paddy Fields must be kept like mud all the time. The economic problems here is that there is not much machinery for reaping the crop and polishing it and the other various jobs. Some places have not got power or much water but the problem is being overcome by the building of large dams which will provide water and power. 10

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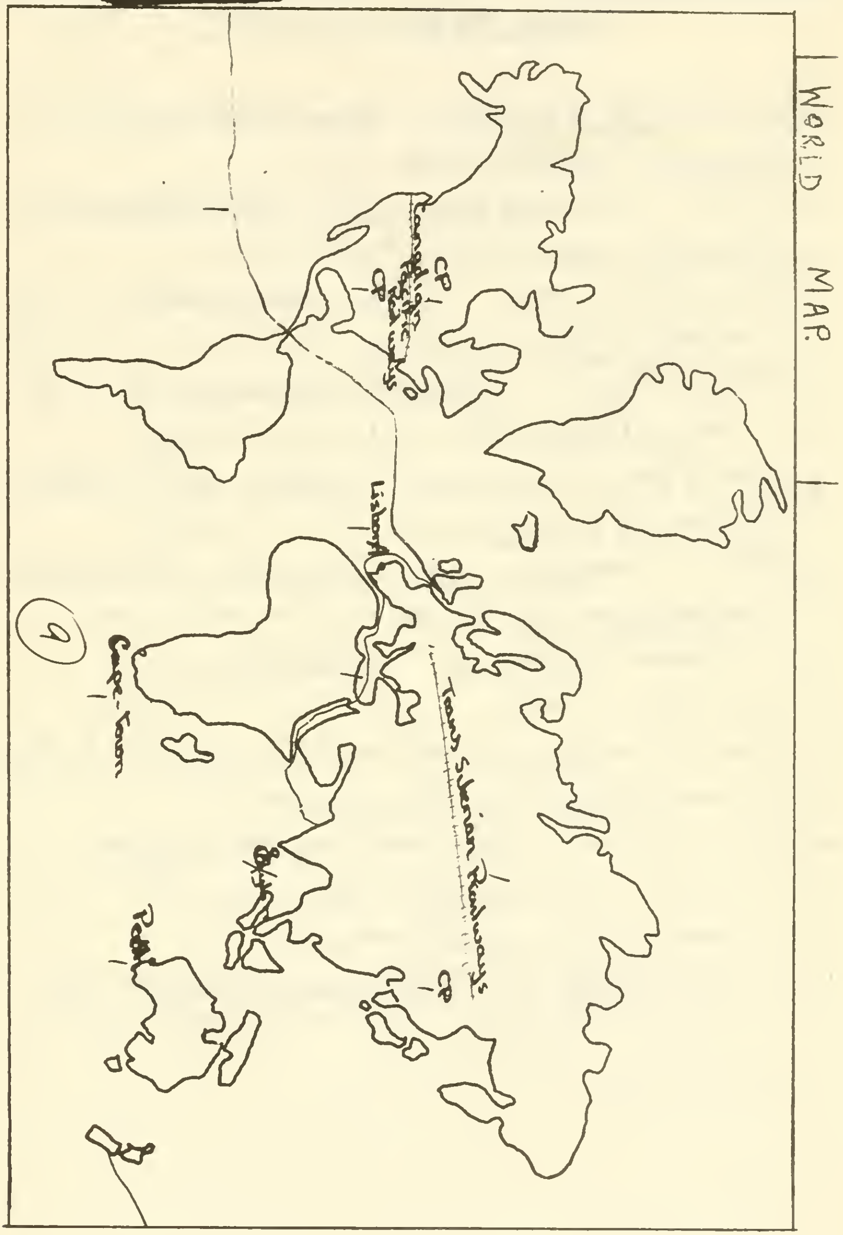
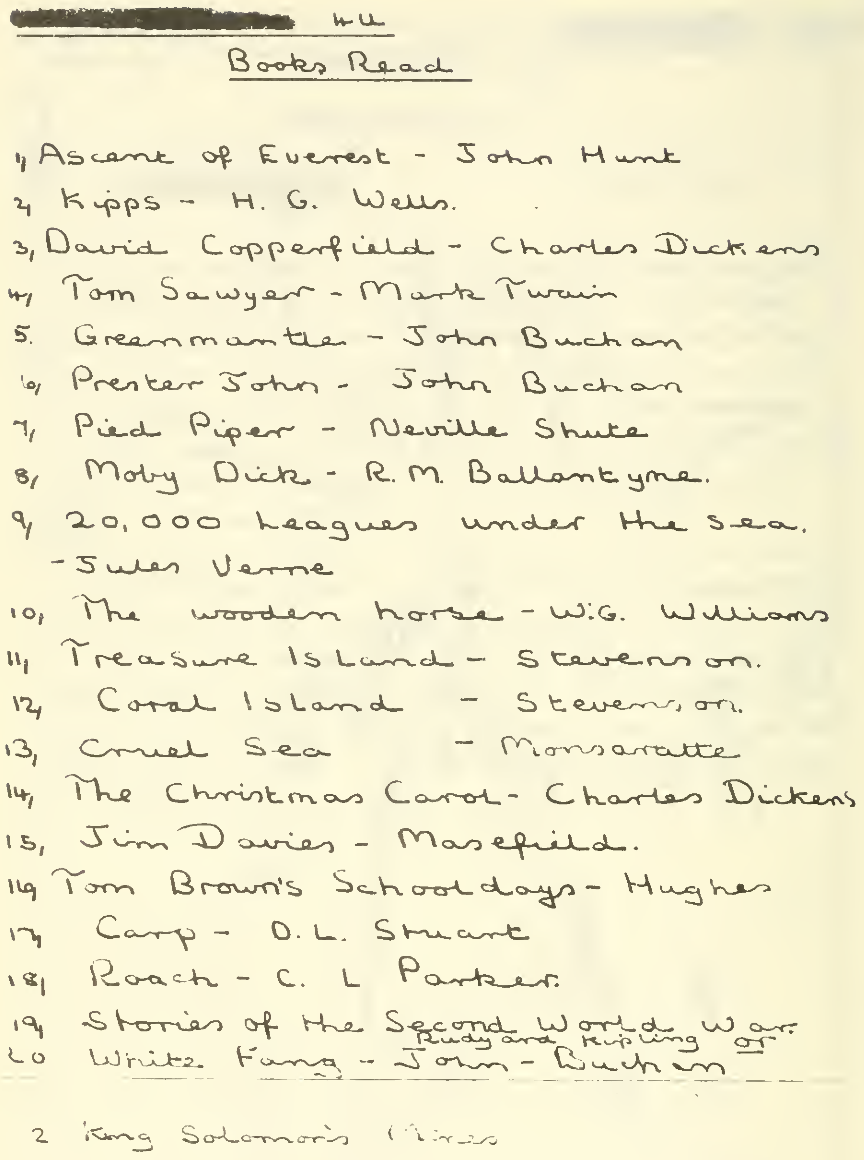
1. The iron ore is put in a large furnaces with coke and lime these take out the impurities as slag, the slag is tapped from the sides of the furnaces. The molten metal is run into troughs called "pigs" and "sows". The metal is called pig iron to make steel the pig iron is put in a container where it is heated and blast of air is sent through it and this takes out more impurities. 14

5910

NAME: [redacted] FORM 4U





[redacted] 4U

Books Read

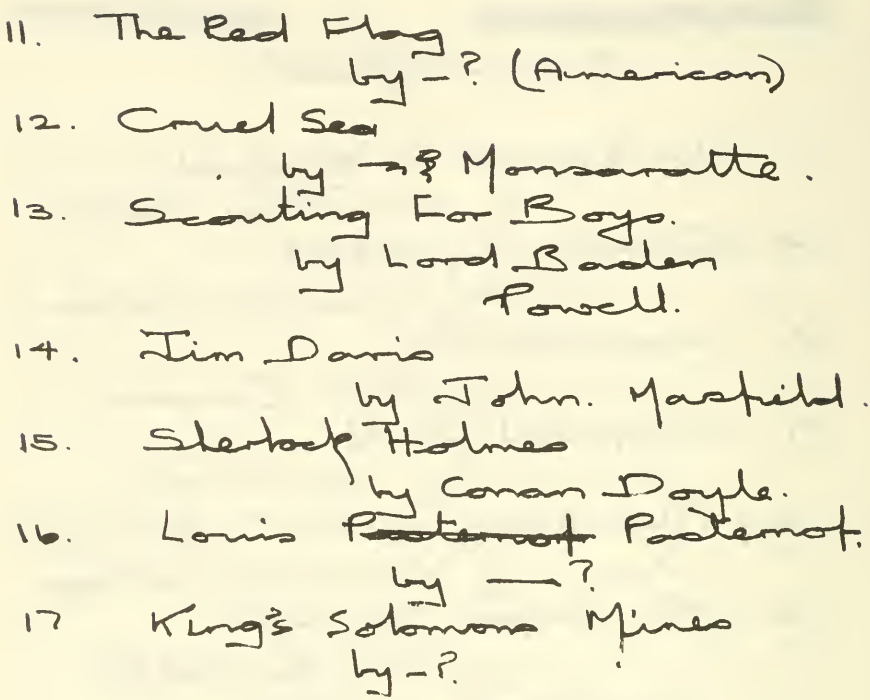
1, Ascant of Everest - John Hunt
2, Kipps - H. G. Wells.
3, David Copperfield - Charles Dickens
4, Tom Sawyer - Mark Twain
5. Greenmantle - John Buchan
6, Prester John - John Buchan
7, Pied Piper - Neville Shute
8, Moby Dick - R. M. Ballantyne.
9, 20,000 Leagues under the sea.
-Jules Verne
10, The wooden horse - W.G. Williams
11, Treasure Island - Stevenson.
12, Coral Island - Stevenson.
13, Cruel Sea - Monsaratte
14, The Christmas Carol - Charles Dickens
15, Jim Davies - Masefield.
16, Tom Brown's Schooldays - Hughes
17, Carp - O. L. Stuart
18, Roach - C. L Parker.
19, Stories of the Second World War.
Rudyard Kipling or
20 White Fang - John - Buchan

2 King Solomon's Mines

[redacted] 4a.

Books Read

1. The Ascent of Everest
by Sir John Hunt.
2. David Copperfield
by Charles Dickens
3. Greenmantle
by John Bucan
4. Elephant Bill
by Williams
5. The Story of the 2nd World War by Katherine Salvagen.
6. The Great Escape
by. Paul Brickhill.
7. Architects of Man
by — ?
8. Operation Cicero
Adapted from Agatha Christe
9. Treasure Island
by. R. L. Stevenson.
10. Six Great Aviators
by — ?



11. The Red Flag
by — ? (American)

12. Cruel Sea
by — ? Monsaratte.

13. Scouting For Boys.
by Lord Baden
Powell.

14. Jim Davis
by John. Masfield.

15. Sherlock Holmes
by Conan Doyle.

16. Louis ~~Pasternot~~ Pasternot.
by — ?

17 King's Solomons Mines
by — ?

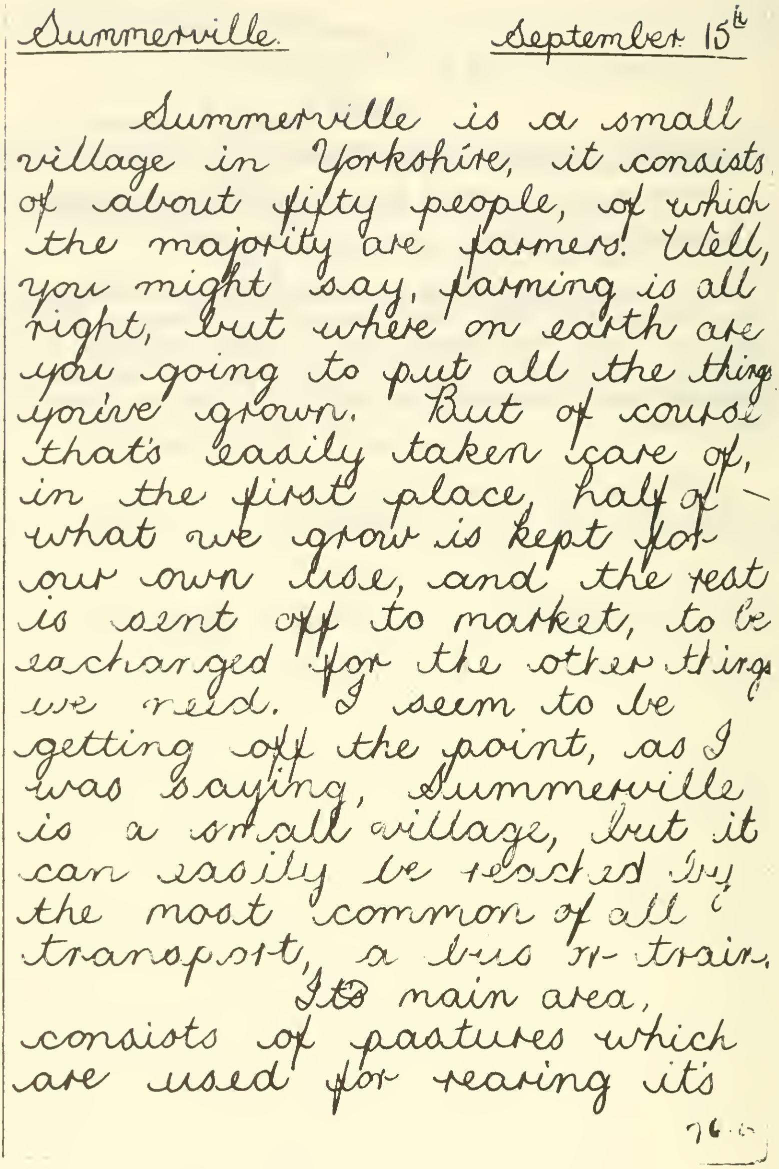
SAMPLE 2

Manchester Secondary Modern School—Top Ability "Stream"

Pupil age 15; finishing fourth form (tenth school year)

Compositions written in class or as homework.

Note.—Teachers feel these particular pupils are unlikely to continue through fifth form; doubt their ability to obtain a GCE "ordinary level" pass. But compositions are neatly written and compare favorably with samples given in press reports of compositions by American high school students participating in the Talent Survey (see Annex 4).

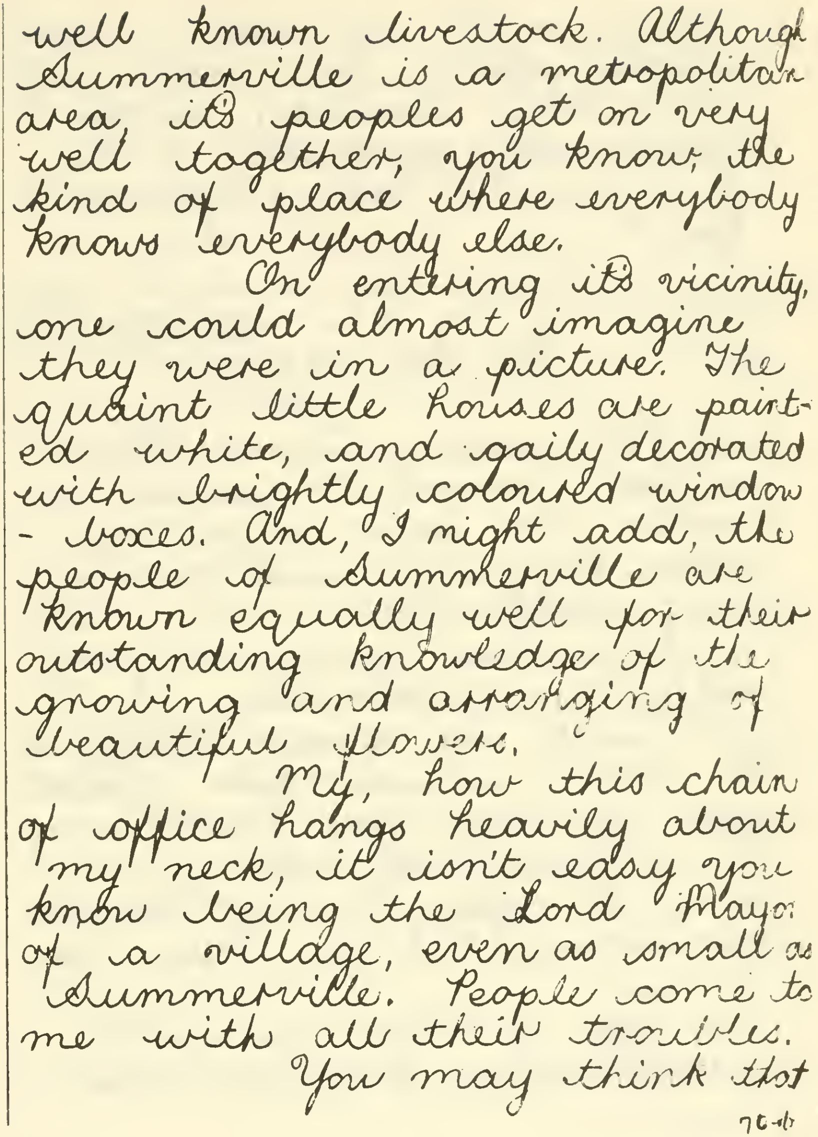


Summerville. September 15th

Summerville is a small village in Yorkshire, it consists of about fifty people, of which the majority are farmers. Well, you might say, farming is all right, but where on earth are you going to put all the things you've grown. But of course that's easily taken care of, in the first place, half of what we grow is kept for our own use, and the rest is sent off to market, to be exchanged for the other things we need. I seem to be getting off the point, as I was saying, Summerville is a small village, but it can easily be reached by the most common of all transport, a bus or train.

Its main area, consists of pastures which are used for rearing it's

76



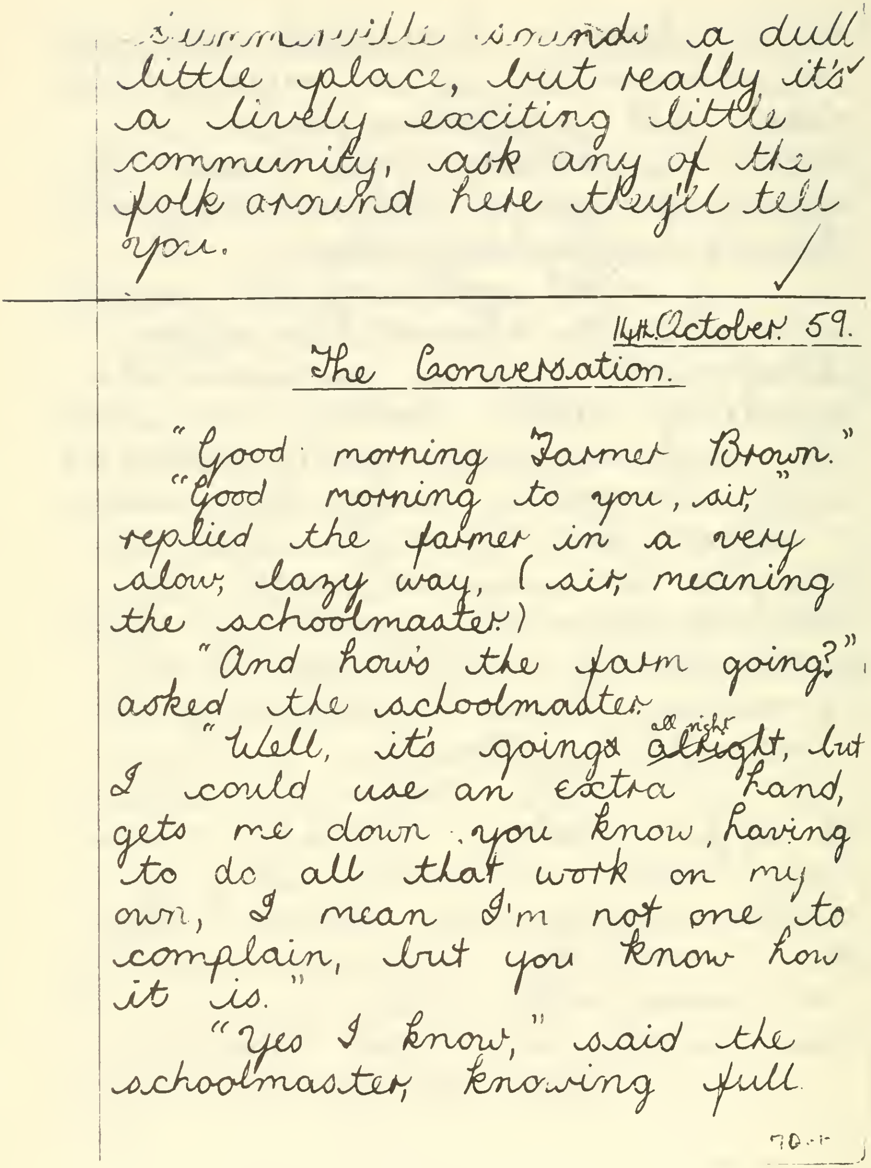
well known livestock. Although Summerville is a metropolitan area, its peoples get on very well together, you know, the kind of place where everybody knows everybody else.

On entering its vicinity, one could almost imagine they were in a picture. The quaint little houses are painted white, and gaily decorated with brightly coloured window-boxes. And, I might add, the people of Summerville are known equally well for their outstanding knowledge of the growing and arranging of beautiful flowers.

My, how this chain of office hangs heavily about my neck, it isn't easy you know being the Lord Mayor of a village, even as small as Summerville. People come to me with all their troubles.

You may think that

70-b



Summerville sounds a dull little place, but really it's a lively exciting little community, ask any of the folk around here they'll tell you. ✓

14th October 59.

The Conversation.

"Good morning Farmer Brown."

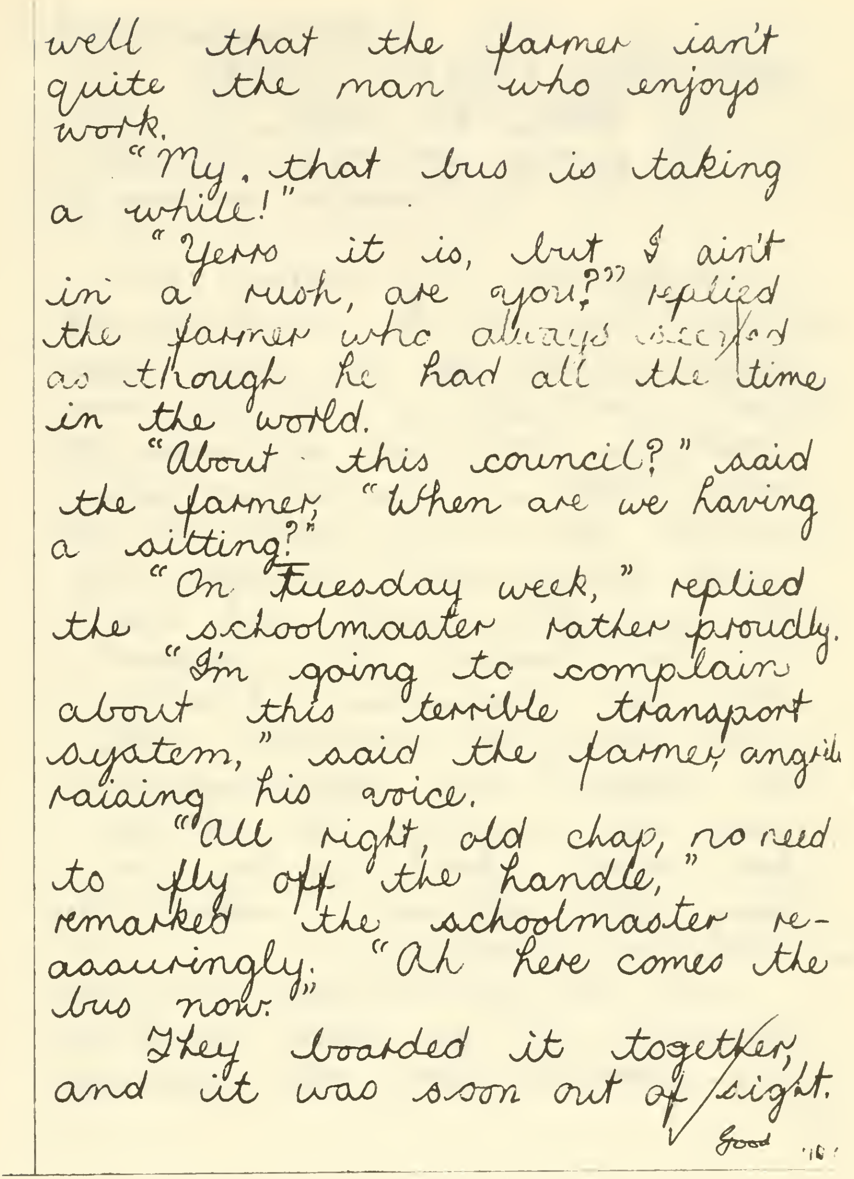
"Good morning to you, sir," replied the farmer in a very slow, lazy way, (sir, meaning the schoolmaster.)

"And how's the farm going?", asked the schoolmaster.

"Well, it's goings all right alright, but I could use an extra hand, gets me down you know, having to do all that work on my own, I mean I'm not one to complain, but you know how it is."

"Yes I know," said the schoolmaster, knowing full

[illegible]



well that the farmer isn't quite the man who enjoys work.

"My, that bus is taking a while!"

"Yerrs it is, but I ain't in a rush, are you?" replied the farmer who always seemed as though he had all the time in the world.

"About this council?" said the farmer, "When are we having a sitting?"

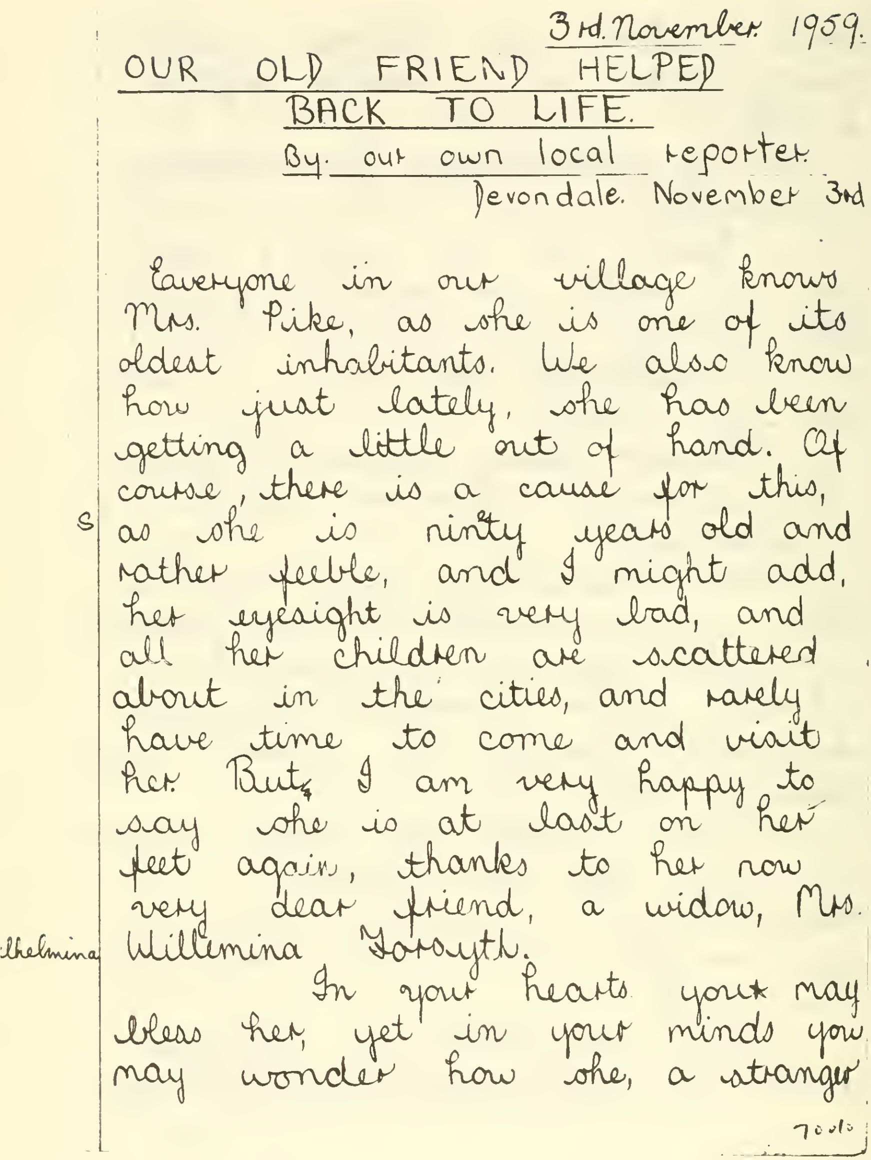
"On Tuesday week," replied the schoolmaster rather proudly.

"I'm going to complain about this terrible transport system," said the farmer, angrily raising his voice.

"All right, old chap, no need to fly off the handle," remarked the schoolmaster re-assuringly. "Ah here comes the bus now."

They boarded it together, and it was soon out of sight.

Good



3rd November 1959.

OUR OLD FRIEND HELPED BACK TO LIFE.

By. our own local reporter.

Devondale. November 3rd

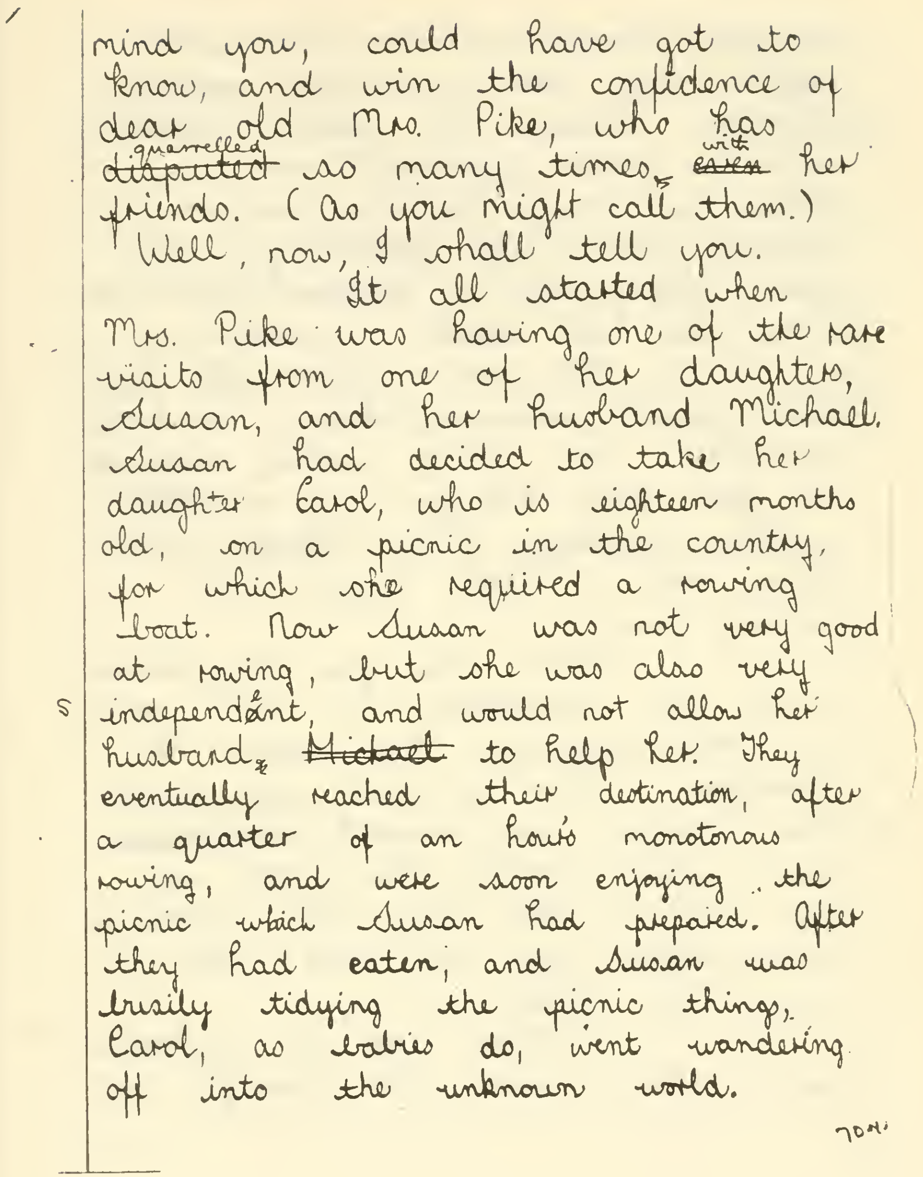
Everyone in our village knows Mrs. Pike, as she is one of its oldest inhabitants. We also know how just lately, she has been getting a little out of hand. Of course, there is a cause for this, as she is ninty years old and rather feeble, and I might add, her eyesight is very bad, and all her children are scattered about in the cities, and rarely have time to come and visit her. But, I am very happy to say she is at last on her feet again, thanks to her now very dear friend, a widow, Mrs. Willemina Forsyth.

s

lhelmina

In your hearts you~~r~~ may bless her, yet in your minds you may wonder how she, a stranger

7ov/o

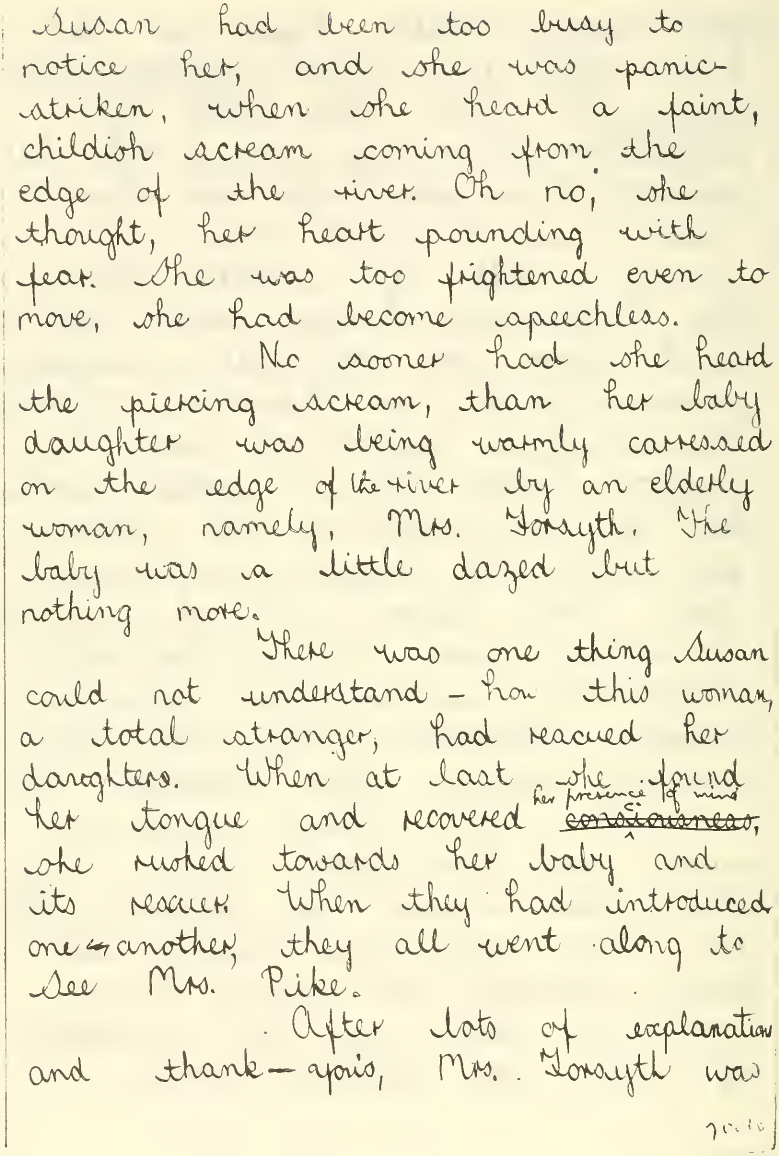


mind you, could have got to know, and win the confidence of dear old Mrs. Pike, who has ~~disputed~~ quarrelled so many times, ~~even~~ with her friends. (As you might call them.)

Well, now, I shall tell you.

It all started when Mrs. Pike was having one of the rare visits from one of her daughters, Susan, and her husband Michael. Susan had decided to take her daughter Carol, who is eighteen months old, on a picnic in the country, for which she required a rowing boat. Now Susan was not very good at rowing, but she was also very independant, and would not allow her husband, ~~Michael~~ to help her. They eventually reached their destination, after a quarter of an hour's monotonous rowing, and were soon enjoying the picnic which Susan had prepared. After they had eaten, and Susan was busily tidying the picnic things, Carol, as babies do, went wandering off into the unknown world.

70%



Susan had been too busy to
notice her, and she was panic-
striken, when she heard a faint,
childish scream coming from the
edge of the river. Oh no, she
thought, her heart pounding with
fear. She was too frightened even to
move, she had become speechless.

No sooner had she heard
the piercing scream, than her baby
daughter was being warmly carressed
on the edge of the river by an elderly
woman, namely, Mrs. Forsyth. The
baby was a little dazed but
nothing more.

There was one thing Susan
could not understand – how this woman,
a total stranger, had rescued her
daughters. When at last she found
S her tongue and recovered her presence of mind ~~consciousness~~,
she rushed towards her baby and
its rescuer. When they had introduced
one another, they all went along to
see Mrs. Pike.

After lots of explanation
and thank-yous, Mrs. Forsyth was

welcomed into the household for tea, and was asked to call again. After several visits she became very friendly with Mrs. Pike, and now she visits her regularly and cleans her house. But, from that day to this, no one in the whole of the village, (not even Susan.) knows how she rescued the child from the river. But there is one consolation, Mrs. Pike is no longer alone.

Well-written - good use of words - but the story is not linked closely enough with the problem of Mrs. Pike.

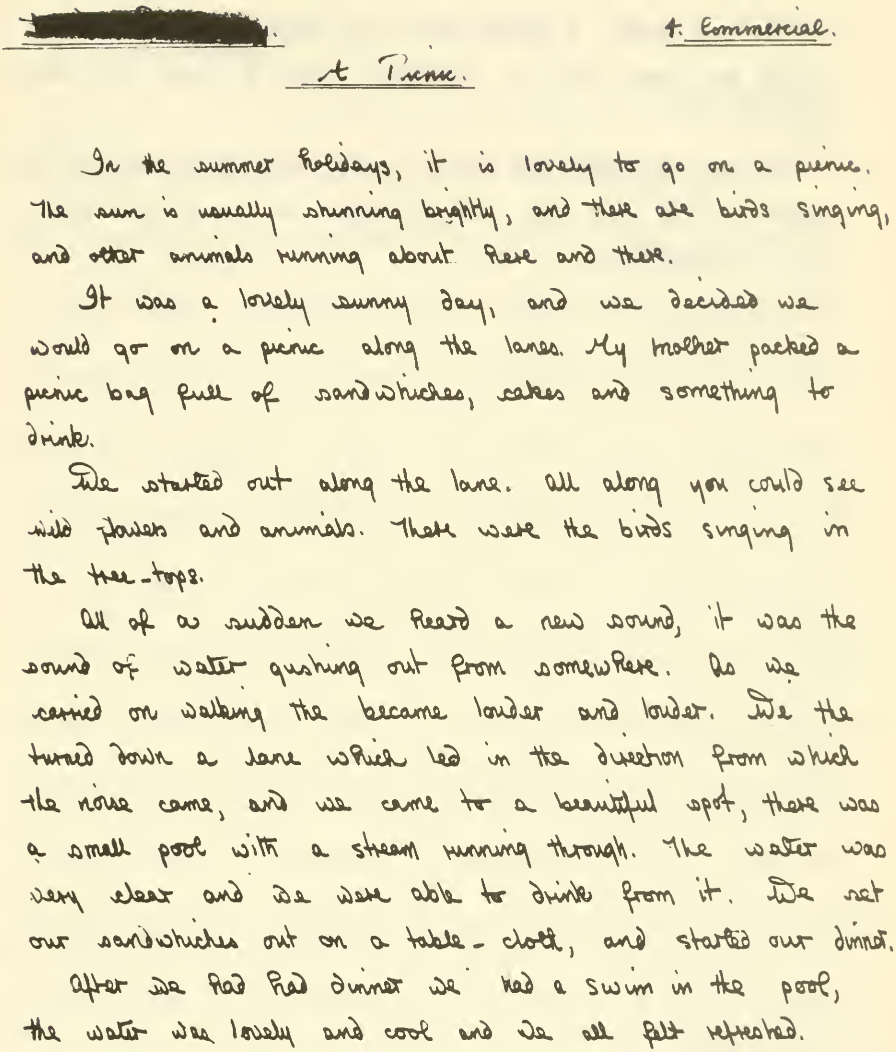
SAMPLE 3

Manchester Secondary Modern School—Average Ability "Stream"

Pupil age 14; finishing fourth form (tenth school year)

Compositions and mathematics tests in class.

NOTE.—All pupils in this group are specializing in "commercial" work, preparing to become secretaries or clerks. Note the neatness of work.



[redacted]. 4. Commercial.

A Picnic.

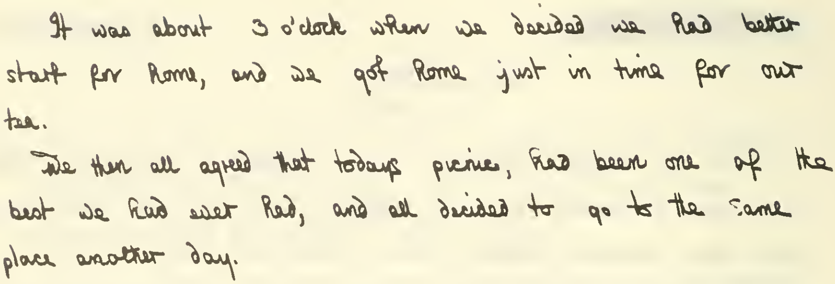
In the summer holidays, it is lovely to go on a picnic. The sun is usually shinning brightly, and there are birds singing, and other animals running about here and there.

It was a lovely sunny day, and we decided we would go on a picnic along the lanes. My mother packed a picnic bag full of sandwhiches, cakes and something to drink.

We started out along the lane. All along you could see wild flowers and animals. There were the birds singing in the tree-tops.

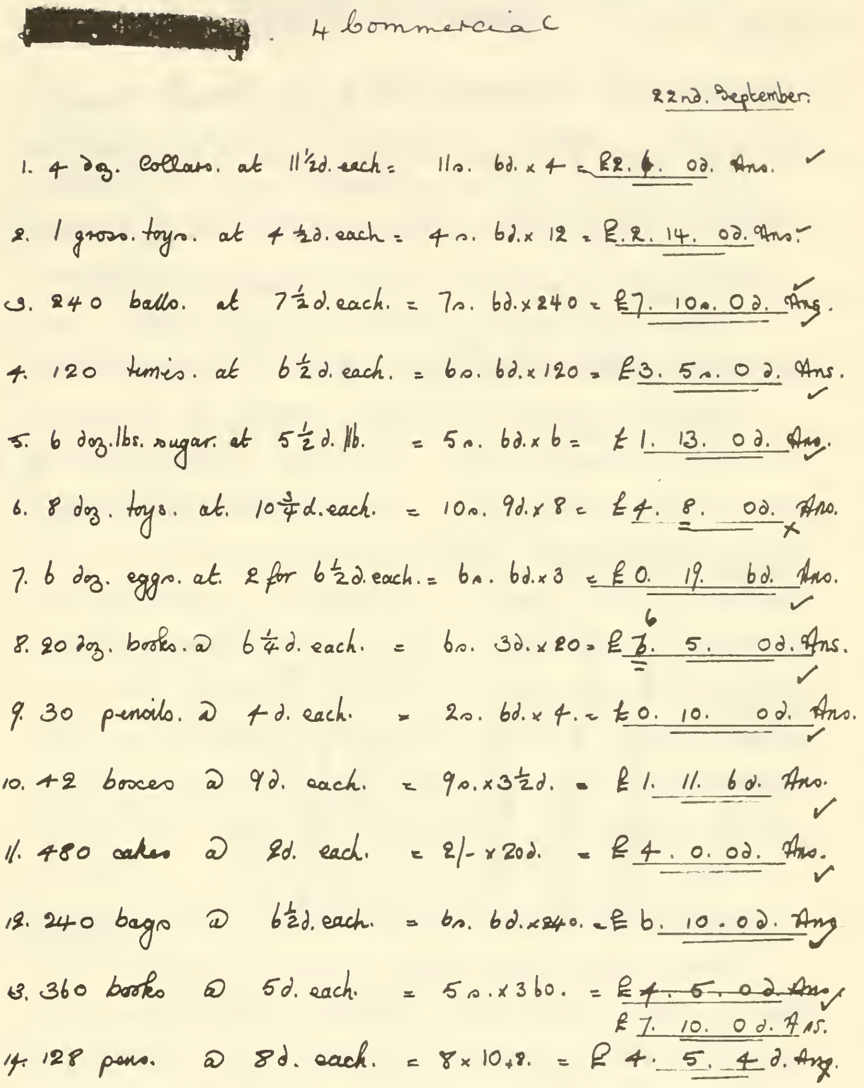
All of a sudden we heard a new sound, it was the sound of water gushing out from somewhere. As we carried on walking the became louder and louder. We the turned down a lane which led in the direction from which the noise came, and we came to a beautiful spot, there was a small pool with a stream running through. The water was very clear and we were able to drink from it. We set our sandwhiches out on a table-cloth, and started our dinner.

After we had had dinner we had a swim in the pool, the water was lovely and cool and we all felt refreshed.



It was about 3 o'clock when we decided we had better start for home, and we got home just in time for our tea.

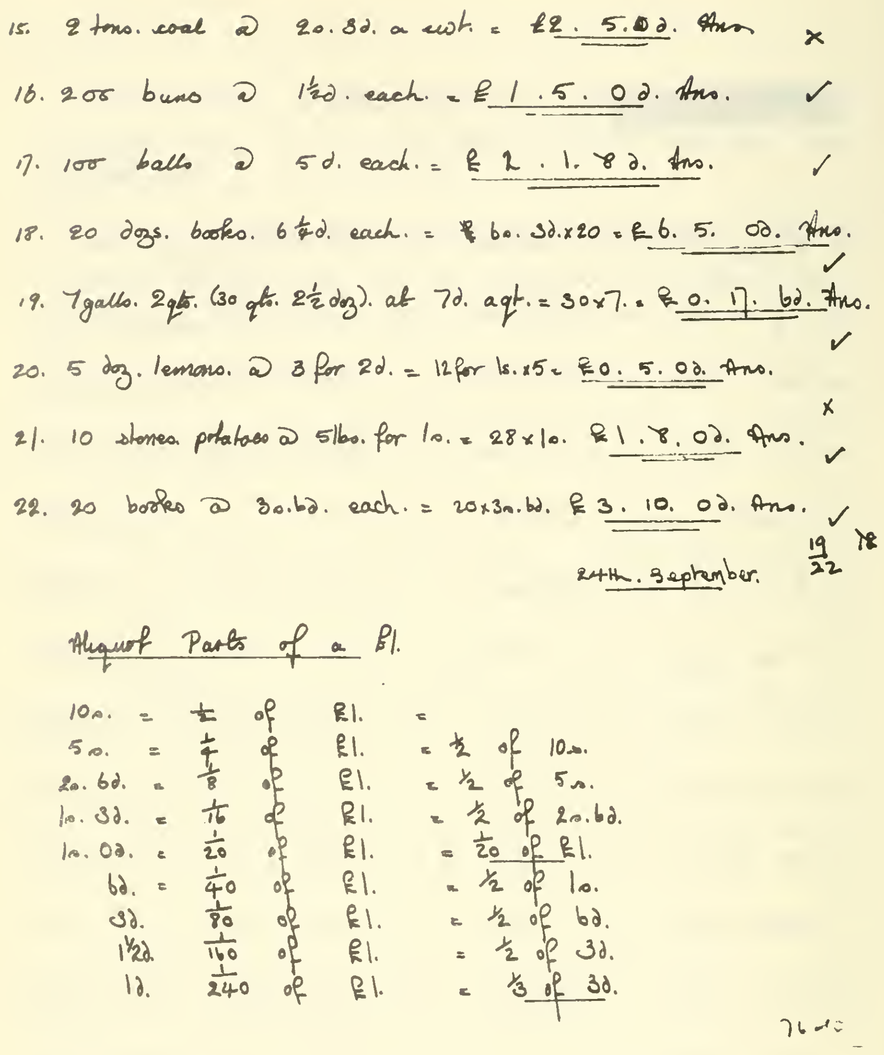
We then all agreed that todays picnic, had been one of the best we had ever had, and all decided to go to the same place another day.



[redacted]. 4 Commercial

22nd. September.

1. 4 doz. Collars. at 11½d. each = 11s. 6d. x 4 = £2. 6. 0d. Ans. ✓
2. 1 gross. toys. at 4½d. each = 4s. 6d. x 12 = £. 2. 14. 0d. Ans. ✓
3. 240 balls. at 7½d. each. = 7s. 6d. x 240 = £7. 10s. 0d. Ans. ✓
4. 120 tins. at 6½d. each. = 6s. 6d. x 120 = £3. 5s. 0d. Ans. ✓
5. 6 doz. lbs. sugar. at 5½d. lb. = 5s. 6d. x 6 = £1. 13. 0d. Ans. ✓
6. 8 doz. toys. at. 10¾d. each. = 10s. 9d. x 8 = £4. 8. 0d. Ans. ✗
7. 6 doz. eggs. at. 2 for 6½d. each. = 6s. 6d. x 3 = £0. 19. 6d. Ans. ✓
8. 20 doz. books. @ 6¼d. each. = 6s. 3d. x 20 = £~~7~~ 6. 5. 0d. Ans. ✓
9. 30 pencils. @ 4d. each. = 2s. 6d. x 4. = £0. 10. 0d. Ans. ✓
10. 42 boxes @ 9d. each. = 9s. x 3½d. = £1. 11. 6d. Ans. ✓
11. 480 cakes @ 2d. each. = 2/- x 20d. = £4. 0. 0d. Ans. ✓
12. 240 bags @ 6½d. each. = 6s. 6d. x 240. = £6. 10. 0d. Ans. ✓
13. 360 books @ 5d. each. = 5s. x 360. = ~~£4. 5. 0d. Ans.~~ ✓
£7. 10. 0d. Ans.
14. 128 pens. @ 8d. each. = 8 x 10+8. = £4. 5. 4d. Ans. ✗



15. 2 tons. coal @ 2s. 3d. a cwt. = £2. 5. 0d. Ans ✗

16. 200 buns @ 1½d. each = £1. 5. 0d. Ans. ✓

17. 100 balls @ 5d. each = £2. 1. 8d. Ans. ✓

18. 20 dozs. books. 6¼d. each = £ 6s. 3d.×20 = £6. 5. 0d. Ans. ✓

19. 7 galls. 2 qts. (30 qts. 2½ doz). at 7d. a qt. = 30×7 = £0. 17. 6d. Ans. ✓

20. 5 doz. lemons. @ 3 for 2d. = 12 for 1s.×5 = £0. 5. 0d. Ans. ✗

21. 10 stones potatoes @ 5lbs. for 1s. = 28×1s. £1. 8. 0d. Ans. ✓

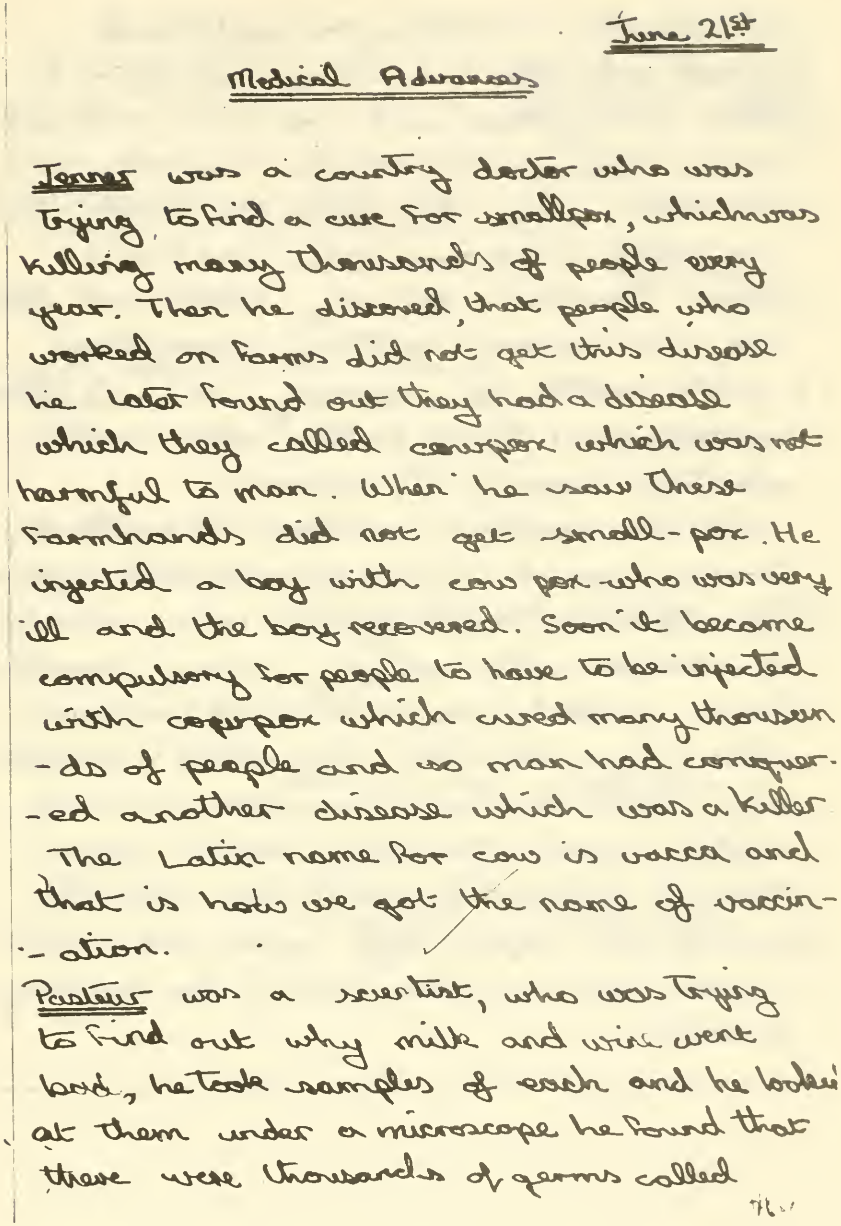
22. 20 books @ 3s. 6d. each = 20×3s. 6d. £3. 10. 0d. Ans. ✓

24th. September. 19/22 18

Aliquot Parts of a £1.

10s. = ½ of £1. =
5s. = ¼ of £1. = ½ of 10s.
2s. 6d. = ⅛ of £1. = ½ of 5s.
1s. 3d. = 1/16 of £1. = ½ of 2s. 6d.
1s. 0d. = 1/20 of £1. = 1/20 of £1.
6d. = 1/40 of £1. = ½ of 1s.
3d. 1/80 of £1. = ½ of 6d.
1½d. 1/160 of £1. = ½ of 3d.
1d. 1/240 of £1. = ⅓ of 3d.

76 [illegible]

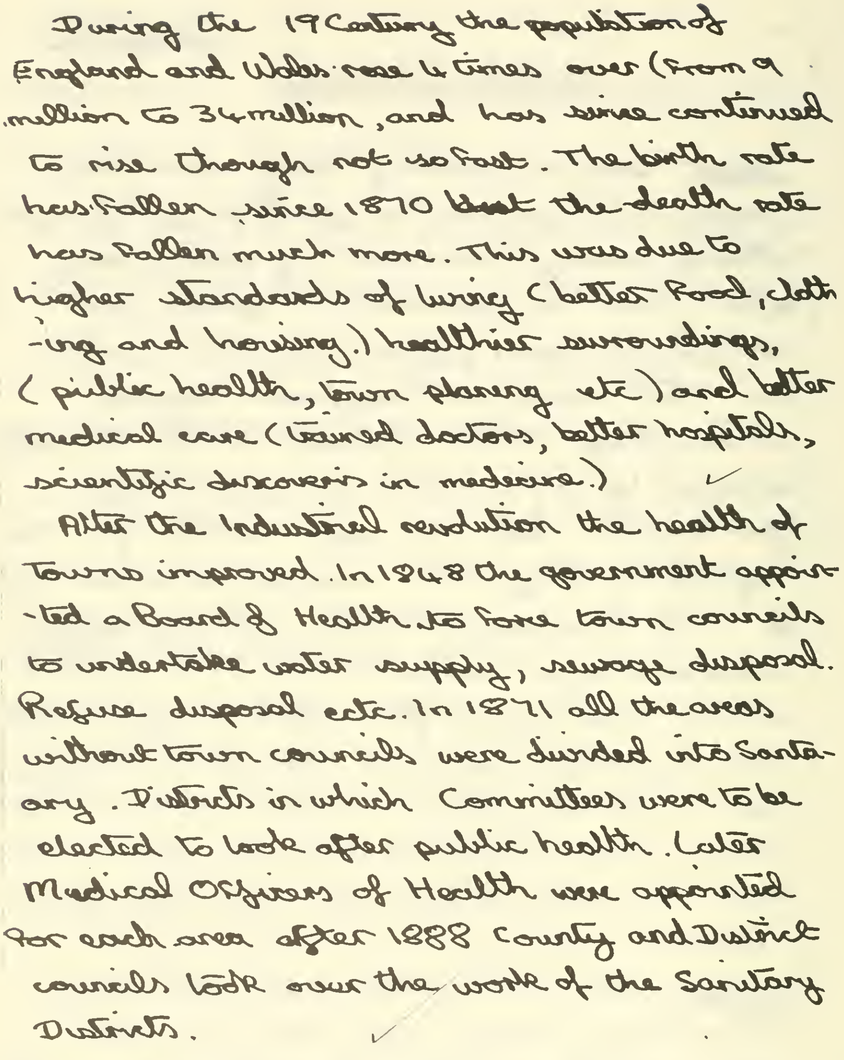


June 21st

Medical Advances

Jenner was a country doctor who was trying to find a cure for smallpox, whichwas killing many thousands of people every year. Than he discoved, that people who worked on farms did not get this disease he later found out they had a disease which they called cowpox which was not harmful to man. When he saw these farmhands did not get small-pox. He injected a boy with cow pox who was very ill and the boy recovered. Soon it become compulsory for people to have to be injected with cowpox which cured many thousends of people and so man had conquered another disease which was a killer The Latin name for cow is vacca and that is how we got the name of vaccination.

Pasteur was a scientist, who was trying to find out why milk and wine went bad, he took samples of each and he looked at them under a microscope he found that there were thousands of germs called



During the 19 Century the population of England and Wales rose 4 times over (from 9 million to 34 million, and has since continued to rise though not so fast. The birth rate has fallen since 1870 but the death rate has fallen much more. This was due to higher standards of living (better food, clothing and housing.) healthier surroundings, (public health, town planing etc) and better medical care (trained doctors, better hospitals, scientific discoveris in medecine.) ✓

After the Industrial revolution the health of towns improved. In 1848 the government appointed a Board of Health to force town councils to undertake water supply, sewage disposal. Refuse disposal etc. In 1871 all the areas without town councils were divided into Sanitary. Districts in which Committees were to be elected to look after public health. Later Medical Officers of Health were appointed for each area after 1888 County and District councils took over the work of the Sanitary Districts. ✓

21st March, 1960.

1) S.P. = 113¾% = £273
C.P. = 100% = £273 ÷ 113¾ × 100

$\frac{\overset{3}{\cancel{273}} \times 4 \times \overset{20}{\cancel{100}}}{\underset{91}{\cancel{455}} \quad 1}$ £240 ANS ✓

2) This weeks attendance = 87½% = 420.
Previous week = 100% = 420 ÷ 87½ × 100

$\frac{\overset{12}{\cancel{420}} \times 2 \times \overset{20}{\cancel{100}}}{\underset{35}{\cancel{175}}}$ = 480 ANS. ✓

3) ~~Before~~ after epedemic. = 82½% = 495.
Before " = 100% = 495 ÷ 82½ × 100.

$\frac{\overset{3}{\cancel{495}} \times 2 \times 100}{\cancel{165}}$ = 600 ANS. ✓

4) S.P = 127½% = £170.
C.P = 100% = £170 ÷ 127½ × 100

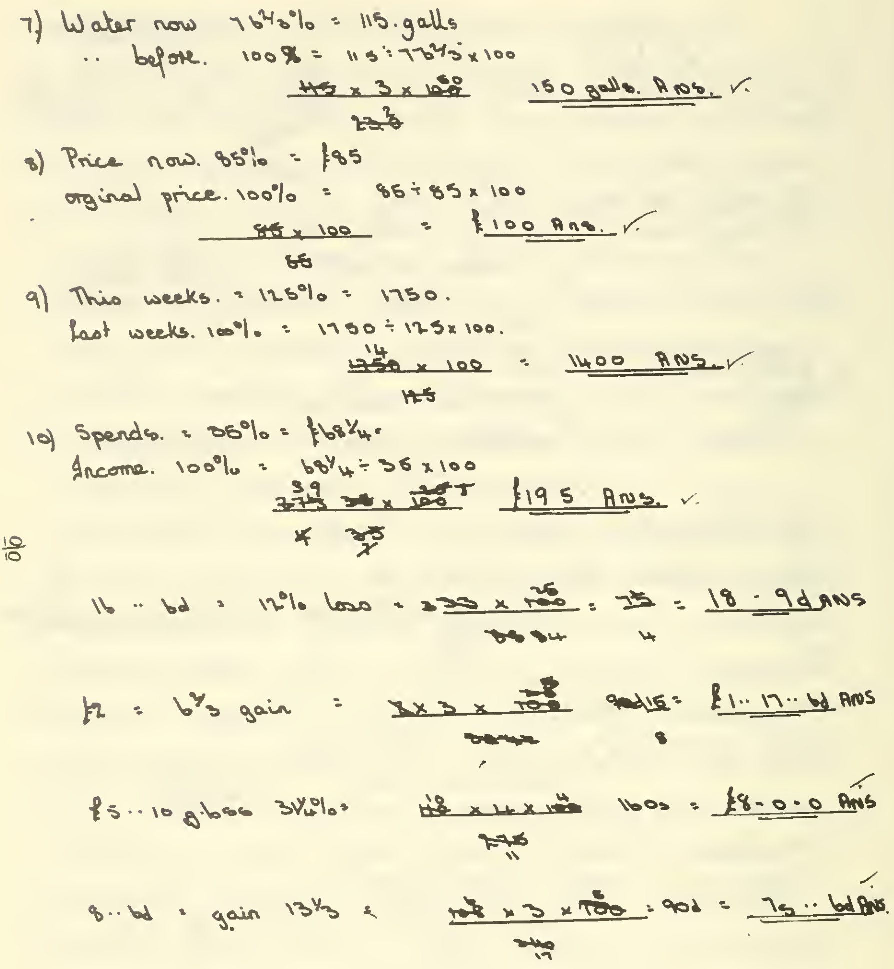
$\frac{\overset{10}{\cancel{170}} \times 2 \times \overset{20}{\cancel{100}}}{\underset{\cancel{15}\,3}{\cancel{255}}} = \frac{400}{3}$ = £133 .. 6 .. 8 ANS. ✓

5) This year. 109¾% ~~of~~ = 878
Last year. 100% = 878 ÷ 109¾ × 100

$\frac{\overset{2}{\cancel{878}} \times 4 \times 100}{\cancel{439}}$ = 800 ANS ✓

6) This year = 106¼% = 21¼ tons
last year = 100% ~~x~~ = 21¼ ÷ 106¼ × 100

$\frac{\cancel{85} \times 4 \times \overset{5}{\cancel{100}}}{\cancel{4} \quad \underset{5}{\cancel{425}}}$ = 20 Tons Ans. ✓



7) Water now $76\frac{2}{3}\%$ = 115.galls
∴ before. 100% = 115 ÷ $76\frac{2}{3}$ × 100
$\frac{\cancel{115} \times 3 \times \overset{50}{\cancel{100}}}{\overset{2}{\cancel{230}}}$ 150 galls. Ans. ✓

8) Price now. 85% = £85
orginal price. 100% = 85 ÷ 85 × 100
$\frac{\cancel{85} \times 100}{\cancel{85}}$ = £100 Ans. ✓

9) This weeks. = 125% = 1750.
last weeks. 100% = 1750 ÷ 125 × 100.
$\frac{\overset{14}{\cancel{1750}} \times 100}{\cancel{125}}$ = 1400 ANS. ✓

10) Spends. = 35% = £$68\frac{1}{4}$.
Income. 100% = $68\frac{1}{4}$ ÷ 35 × 100
$\frac{\overset{39}{\cancel{273}}\ \cancel{35} \times \overset{\cancel{25}\,5}{\cancel{100}}}{\cancel{4}\quad \underset{\cancel{7}}{\cancel{35}}}$ £195 Ans. ✓

$\frac{10}{10}$

16 .. 6d = 12% loss = $\frac{\cancel{2}\,\cancel{33} \times \overset{25}{\cancel{100}}}{\cancel{88}\ 84}$ = $\frac{75}{4}$ = 18 - 9d ANS

£2 = $6\frac{2}{3}$ gain = $\frac{\cancel{2} \times 3 \times \overset{\cancel{20}\,8}{\cancel{100}}}{\cancel{320}}$ $\frac{15}{8}$ = £1 .. 17 .. 6d ANS

£5 .. 10 g.loss $3\frac{1}{4}\%$ = $\frac{\overset{10}{\cancel{110}} \times 4 \times \overset{4}{\cancel{100}}}{\underset{11}{\cancel{275}}}$ 160s = £8 - 0 - 0 ANS ✓

8 .. 6d = gain $13\frac{1}{3}$ = $\frac{\overset{3}{\cancel{102}} \times 3 \times \overset{5}{\cancel{100}}}{\underset{17}{\cancel{340}}}$ = 90d = 7s .. 6d Ans. ✓

5b. $\frac{49·5 \times 14·68}{4·79}$

1644
24
1668

Log of 49·5 : 1·6946
" " 14·68 : 1·1668
2·8614
" " 4·79 : 0·6803
2·1811
= 1517 = 152 Ans.
✓

5c. $\frac{276·4 \times 97·6}{150}$

4409
6
4415

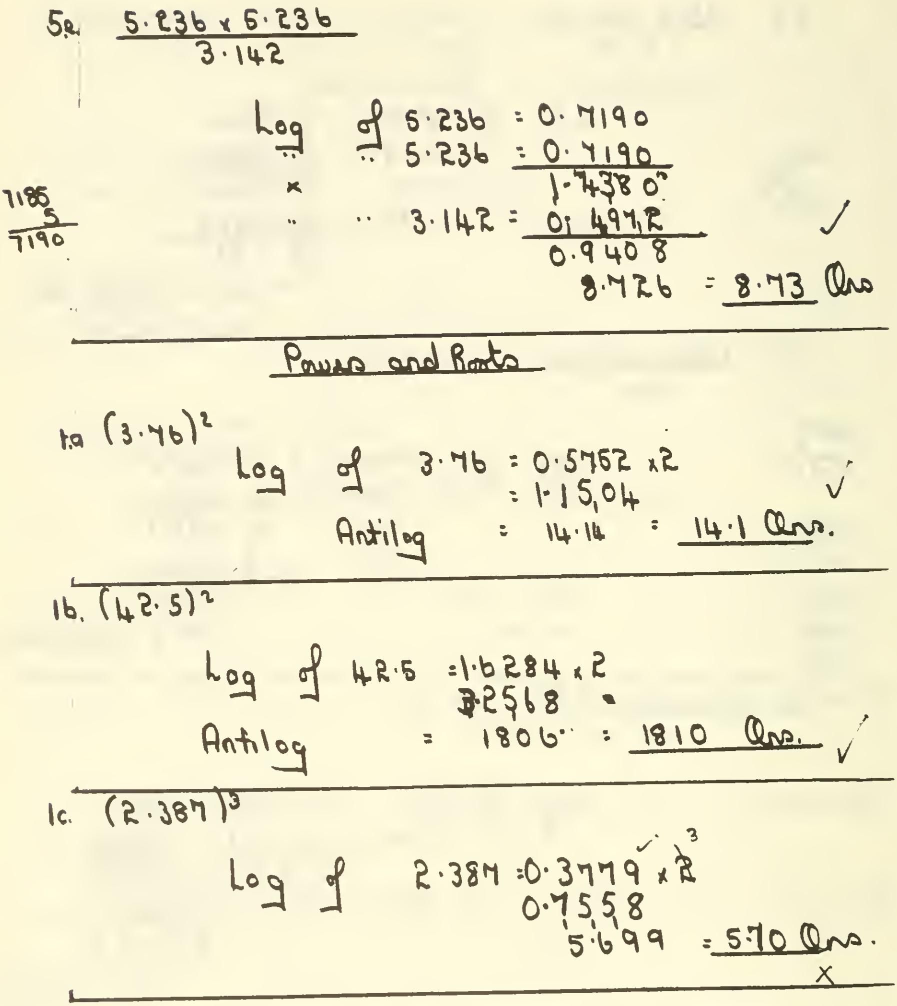
1795
3

2748
3
2751

Log of 276·4 = 2·4415
" " 97·6 = 1·9894
4·4309
" " 150 = 2·1761
2·2548
179·8 = 180 Ans.

5d. $\frac{57 \times 27·9}{39·4}$ ✓

Log of 57 = 1·3715 = 1·7559 ✓
" " 27·9 = 1·1901 = 1·2790 ✗
2·5616 = 3·0349
" " 39·4 = 2477 = 1·5955 ✓
1·4394
= 2751 = 27·5
✗



5e. $\frac{5{\cdot}236 \times 5{\cdot}236}{3{\cdot}142}$

7185
5
7190

Log of 5·236 = 0·7190
" " 5·236 = 0·7190
1·4380
× " " 3·142 = 0·4972
0·9408
8·726 = 8·73 Ans ✓

Powers and Roots

1a $(3{\cdot}76)^2$
Log of 3·76 = 0·5752 ×2
= 1·1504 ✓
Antilog = 14·14 = 14·1 Ans.

1b. $(42{\cdot}5)^2$
Log of 42·5 = 1·6284 × 2
3·2568
Antilog = 1806 = 1810 Ans. ✓

1c. $(2{\cdot}387)^3$
Log of 2·387 = 0·3779 × $\overset{3}{\cancel{2}}$
0·7558
5·699 = 5·70 Ans.
×

26. $T = \frac{\overset{2}{\cancel{100}}\times\cancel{25}}{\underset{23}{\cancel{115}}\times 5\times\cancel{20}} = \frac{1}{5} = \cancel{D}\ 43\text{ days.}$ ✓

---

27 $R = \frac{\overset{5}{\cancel{100}}\times\cancel{109}\times\overset{73}{\cancel{365}}}{\underset{3}{\cancel{60}}\times\cancel{73}\times\underset{\cancel{\frac{545}{109}}}{\cancel{3475}}} = \frac{5}{3} = £1\frac{2}{3} = £1..13..4d$

$224\frac{1}{2}$.
$\cdot 2425$

✗

$\underline{31}$. ~~28~~ $R. = \frac{\cancel{100}\times\overset{3}{\cancel{12}}\times 3}{\cancel{1200}} = 6\%$ Ans. ✓

---

24 $R = \frac{\overset{5}{\cancel{100}}\times\cancel{8}\times\cancel{14}\times\overset{5}{\cancel{365}}}{\underset{4}{\cancel{292}}\times\cancel{8}\times\underset{4}{\cancel{80}}} = \frac{35}{4} = 6\frac{1}{4}\%$

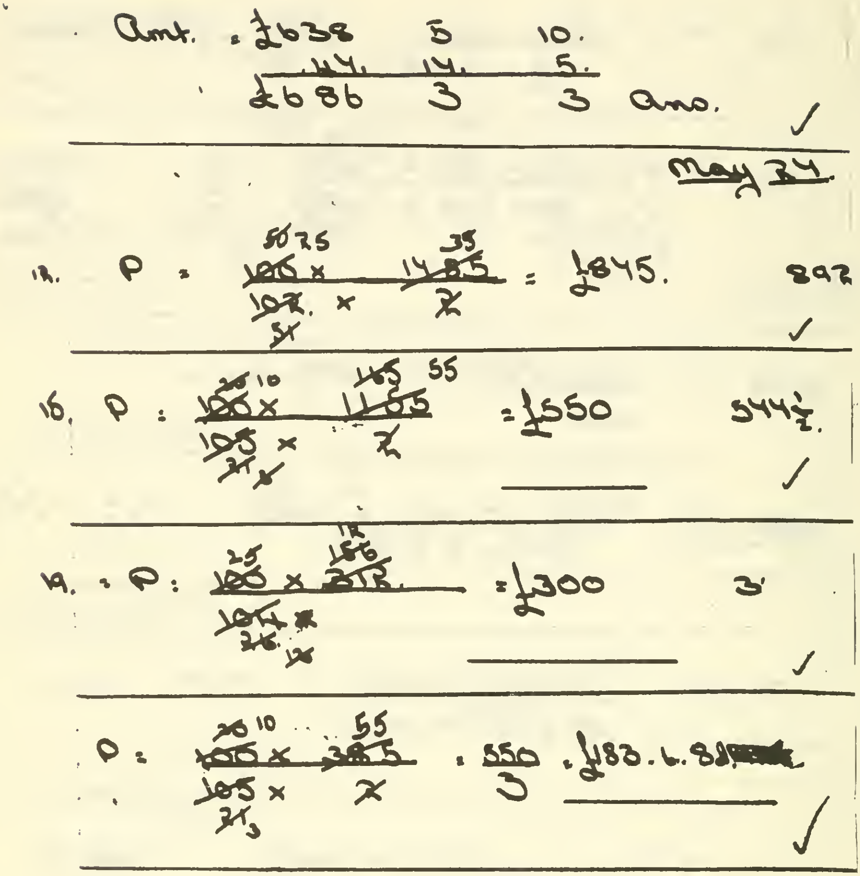
---

24. $R = \frac{\overset{4}{\cancel{100}}\times\cancel{109}\times\cancel{18}\times\cancel{5}}{\underset{12}{\cancel{60}}\times\cancel{73}\times\underset{109}{\cancel{3475}}} = 4\%$ Ans. ✓

---

28. $S.\ Int. = \frac{15319\times\cancel{5}\times\cancel{5}}{\underset{8}{\cancel{24}}\times 2\times\underset{20}{\cancel{100}}} = \frac{15319}{320}$

$= £44\ {}^{309}/_{320} = £44/14/5d.$



Amt. = £638 5 10.
47. 17. 5.
£686 3 3 Ans. ✓

May 34.

13. P = $\frac{\overset{50\ 25}{\cancel{100}} \times \overset{35}{\cancel{1485}}}{\underset{51}{\cancel{102}} \times \cancel{2}}$ = £845. 892 ✓

16. P = $\frac{\overset{\cancel{20}\ 10}{\cancel{100}} \times \overset{\cancel{165}\ 55}{\cancel{1155}}}{\underset{\cancel{21}\ \cancel{7}}{\cancel{105}} \times \cancel{2}}$ = £550 544½. ✓

19. P = $\frac{\overset{25}{\cancel{100}} \times \overset{\overset{12}{\cancel{156}}}{\cancel{312}}}{\underset{\underset{\cancel{13}}{\cancel{26}}}{\cancel{104}} \times \cancel{2}}$ = £300 3 ✓

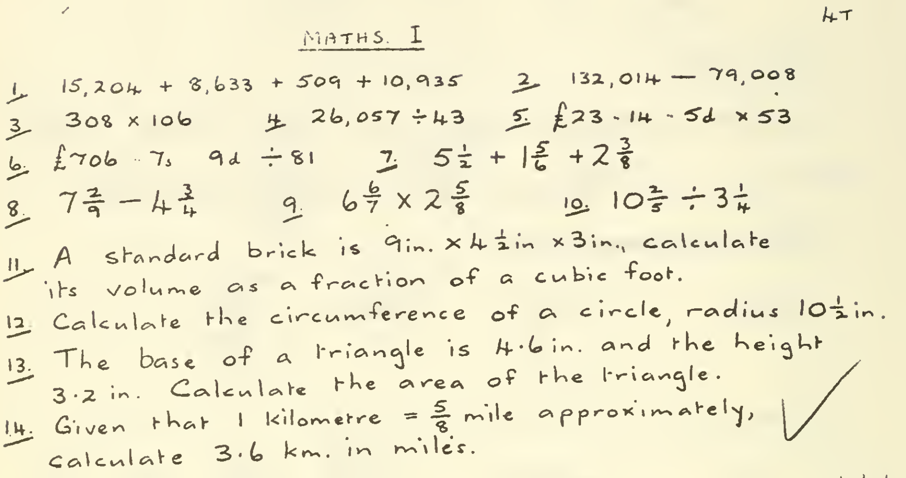
P = $\frac{\overset{\cancel{20}\ 10}{\cancel{100}} \times \overset{55}{\cancel{385}}}{\underset{\cancel{21}\ 3}{\cancel{105}} \times \cancel{2}}$ = $\frac{550}{3}$ = £183.6.8 ✓

SAMPLE 4

Manchester Secondary Modern School—Below Average Ability "Stream"

Pupil age 14; finishing fourth form (tenth school year)

Midterm mathematics test.

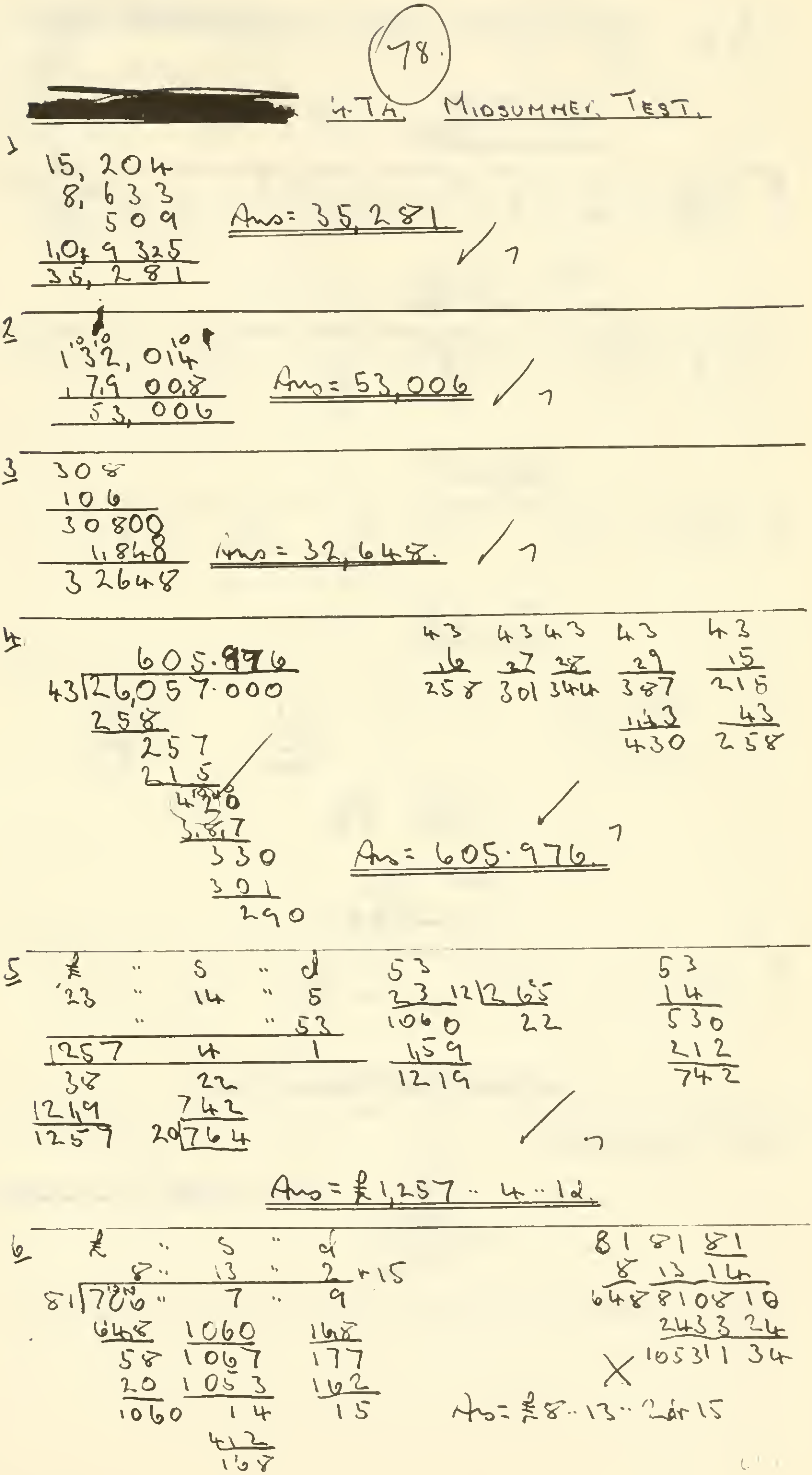


4T

MATHS. I

1. 15,204 + 8,633 + 509 + 10,935 2. 132,014 — 79,008
3. 308 × 106 4. 26,057 ÷ 43 5. £23 · 14 · 5d × 53
6. £706 · 7s 9d ÷ 81 7. $5\frac{1}{2} + 1\frac{5}{6} + 2\frac{3}{8}$
8. $7\frac{2}{9} - 4\frac{3}{4}$ 9. $6\frac{6}{7} \times 2\frac{5}{8}$ 10. $10\frac{2}{5} \div 3\frac{1}{4}$
11. A standard brick is 9 in. × $4\frac{1}{2}$ in × 3 in., calculate its volume as a fraction of a cubic foot.
12. Calculate the circumference of a circle, radius $10\frac{1}{2}$ in.
13. The base of a triangle is 4·6 in. and the height 3·2 in. Calculate the area of the triangle.
14. Given that 1 kilometre = $\frac{5}{8}$ mile approximately, calculate 3·6 km. in miles.

✓



78

[redacted] 4 TA. Midsummer Test.

1
15, 204
8, 633
509
1,0,9 325
35, 281
Ans = 35,281 ✓ 7

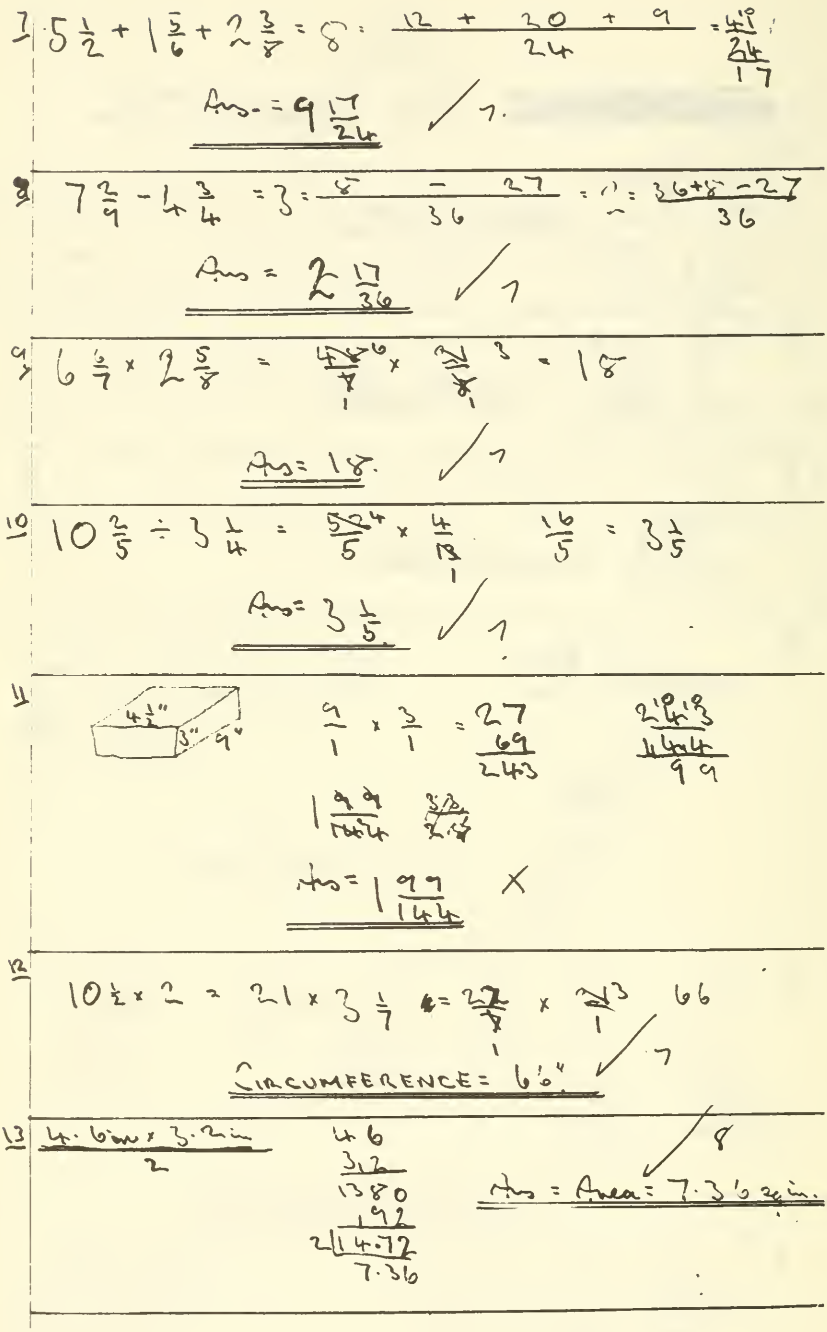
2
132, 014
79 008
53, 006
Ans = 53,006 ✓ 7

3
308
106
30800
1,848
32648
Ans = 32,648. ✓ 7

4
605·976
43|26,057·000
258
257
215
420
387
330
301
290
43 × 6 = 258, 43 × 7 = 301, 43 × 8 = 344, 43 × 9 = 387, 43 × 5 = 215
387 + 43 = 430, 215 + 43 = 258
Ans = 605·976. ✓ 7

5
£ .. s .. d
23 .. 14 .. 5
.. .. 53
1257 4 1
38 22
1219 742
1257 20|764
53 × 23 = 1060 + 159 = 1219; 12|265 = 22
53 × 14 = 530 + 212 = 742
Ans = £1,257 .. 4 .. 1d. ✓ 7

6
£ .. s .. d
8 .. 13 .. 2 r 15
81|706 .. 7 .. 9
648 1060 168
58 1067 177
20 1053 162
1060 14 15
412
168
81 × 8 = 648, 81 × 13 = 810 810, 81 × 14 = 810 + 2433 24
105311 34 ✗
Ans = £8 .. 13 .. 2d r 15



7 $5\frac{1}{2} + 1\frac{5}{6} + 2\frac{3}{8} = 8 : \frac{12 + 20 + 9}{24} = \frac{41}{24}$ $\quad \begin{array}{r} 41 \\ \underline{24} \\ 17 \end{array}$

Ans. = $9\frac{17}{24}$ ✓ 1.

---

8 $7\frac{2}{9} - 4\frac{3}{4} = 3 : \frac{8 - 27}{36} = 2 : \frac{36+8-27}{36}$

Ans = $2\frac{17}{36}$ ✓ 1

---

9 $6\frac{6}{7} \times 2\frac{5}{8} = \frac{\cancel{48}^{6}}{\cancel{7}_{1}} \times \frac{\cancel{21}^{3}}{\cancel{8}_{1}} = 18$

Ans = 18. ✓ 1

---

10 $10\frac{2}{5} \div 3\frac{1}{4} = \frac{\cancel{52}^{4}}{5} \times \frac{4}{\cancel{13}_{1}} \quad \frac{16}{5} = 3\frac{1}{5}$

Ans = $3\frac{1}{5}$ ✓ 1

11

$\frac{9}{1} \times \frac{3}{1} = 27 \quad \begin{array}{r} 27 \\ \underline{69} \\ 243 \end{array} \qquad \begin{array}{r} 243 \\ \underline{144} \\ 99 \end{array}$

$1\frac{99}{144}$ [illegible]

Ans = $1\frac{99}{144}$ ✗

---

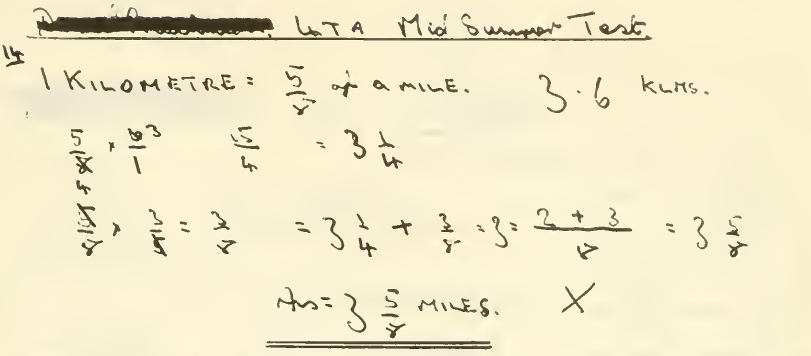
12 $10\frac{1}{2} \times 2 = 21 \times 3\frac{1}{7} = \frac{\cancel{22}}{\cancel{7}_{1}} \times \frac{\cancel{21}^{3}}{1}$ 66

CIRCUMFERENCE = 6' 6" ✓ 1

---

13 $\frac{4\cdot6\text{ in} \times 3\cdot2\text{ in}}{2}$ $\quad \begin{array}{r} 46 \\ \underline{32} \\ 1380 \\ \underline{92} \\ 2\,)\,14\cdot72 \\ 7\cdot36 \end{array}$

Ans = Area = 7·36 sq. in. ✓ 8



[redacted] 4TA Mid Summer Test

4 1 KILOMETRE = $\frac{5}{8}$ of a MILE. 3·6 KLMS.

$\frac{5}{\cancel{8}_{4}} \times \frac{\cancel{6}^{3}}{1}$ $\frac{15}{4}$ $= 3\frac{1}{4}$

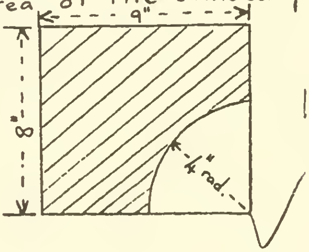
$\frac{\cancel{5}}{8} \times \frac{3}{\cancel{5}} = \frac{3}{8}$ $= 3\frac{1}{4} + \frac{3}{8} = 3 = \frac{2+3}{8} = 3\frac{5}{8}$

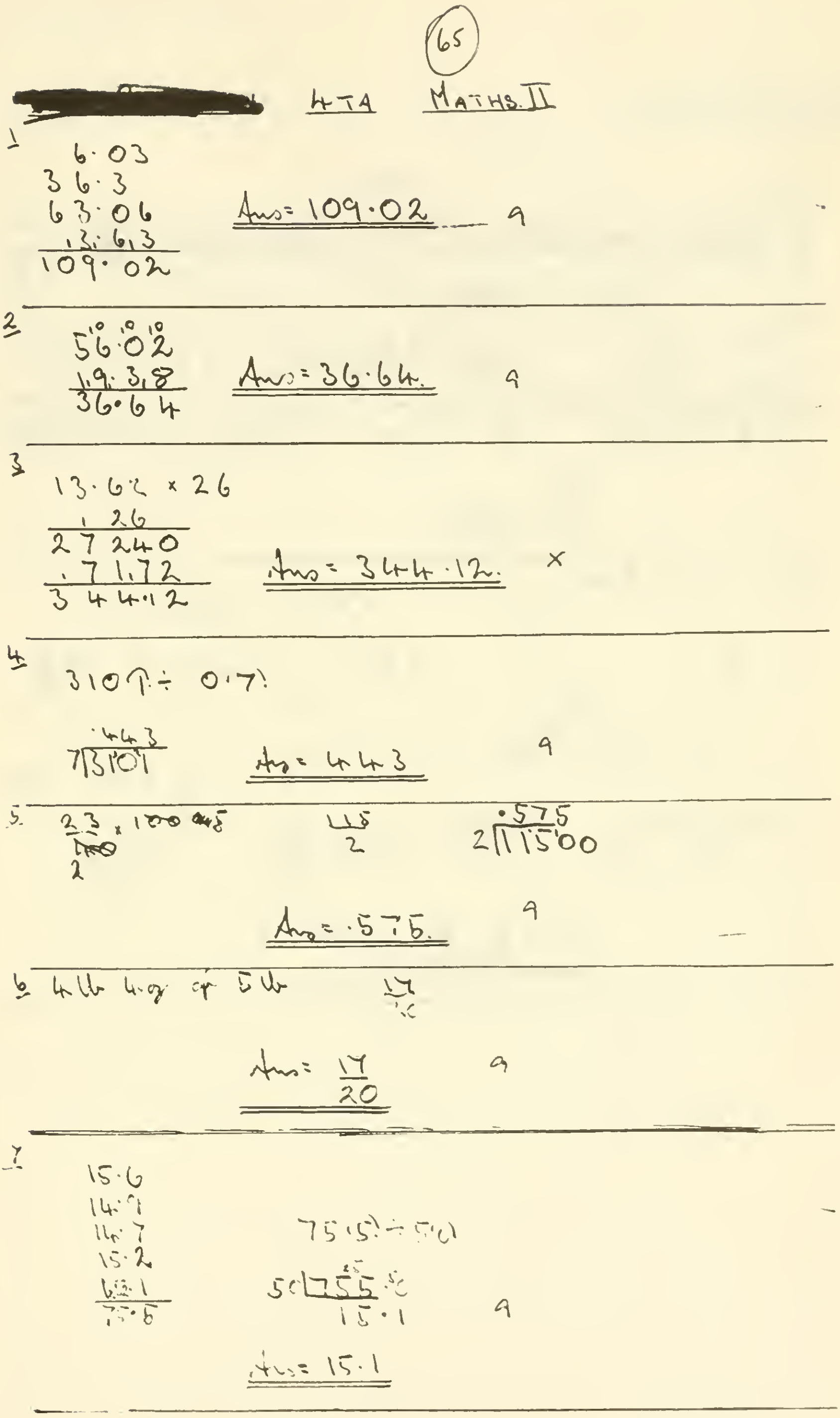
Ans = $3\frac{5}{8}$ MILES. X

MATHS II

4T.

1 6·03 + 36·3 + 63·06 + 3·63
2 56·02 — 19·38
3. 13·62 × 26
4 310·1 ÷ 0·7
5 Write $\frac{23}{40}$ as a decimal fraction.
6 What fraction is 4 lbs. 4 oz. of 5 lb.?
7. Find the average of 15·6, 14·9, 14·7, 15·2 and 15·1.
8 The internal measurements of a tank are 10 ft. by 8 ft. by 5 ft. 3 ins.; find, in cu. ft., how much water the tank can hold.
9 A map is drawn to a scale of 2½ in. to a mile. What length on the map represents 220 yd?
10 Calculate the area of the shaded part of the figure:





65

[redacted] 4TA MATHS. II

1
6·03
36·3
63·06
13·63
109·02
Ans = 109·02 9

2
56·02
19·38
36·64
Ans = 36·64. 9

3
13·62 × 26
26
27240
7172
344·12
Ans = 344·12. ×

4
3101 ÷ 0·7
·443
7|3101
Ans = 443 9

5
23/~~100~~2 × ~~100~~ 115/2
·575
2|115·00
Ans = ·575. 9

6 4 lb 4 oz of 5 lb 17/20
Ans = 17/20 9

7
15·6
14·9
14·7
15·2
15·1
75·5
75·5 ÷ 5·0
50|755
15·1 9
Ans = 15·1

8. 10 ft × 8 ft × 5 ft 3 in. $80 \times 5\frac{1}{4} = \frac{\overset{20}{\cancel{80}}}{1} \times \frac{21}{\underset{1}{\cancel{4}}}$

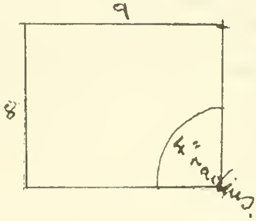
420

Ans = 420 cu ft. ||

9. $\frac{1}{8}$ of $2\frac{1}{2} = \frac{5}{\cancel{2}} \times \frac{\cancel{8}^{4}}{1}$ 20

Ans = $\frac{1''}{20}$ X

10.



$8 \times 9 = 72$ sq in

$3\frac{1}{7} \times 4 = \frac{22}{7} \times \frac{4}{1}$ $\frac{88}{7}$ X X

$7\frac{4}{7} \times 7\frac{\cancel{4}}{\cancel{7}} = \frac{53}{7} \times \frac{53}{7}$

$= \frac{2809}{49} \times \frac{1}{4}$ $\frac{2809}{196}$ $196\overline{)2809}$ 14 $14\frac{65}{196}$

Ans = $14\frac{65}{196}$ sq ft X

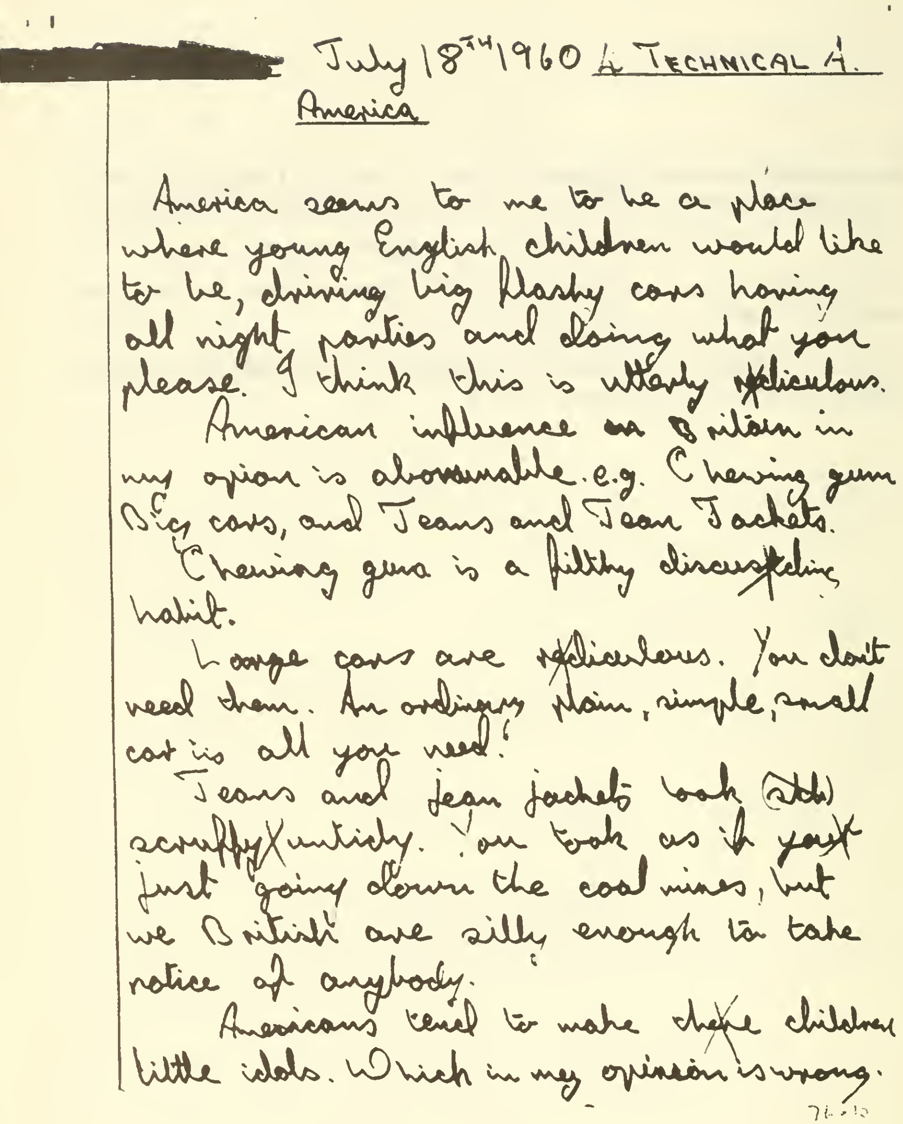
SAMPLE 5

Manchester Secondary Modern School—Remedial Group of Lowest Ability "Stream"—Reading Retardation About Two Years

Pupil age 14; finishing tenth school year

Compositions and mathematics tests. Time allowed for composition: 25 minutes.

Note.—Compositions should be compared with work of American school children in Annexes 3 and 4.



[redacted] July 18TH 1960 4 TECHNICAL 4.

America

America seems to me to be a place where young English children would like to be, driving big flashy cars having all night parties and doing what you please. I think this is utterly ridiculous.

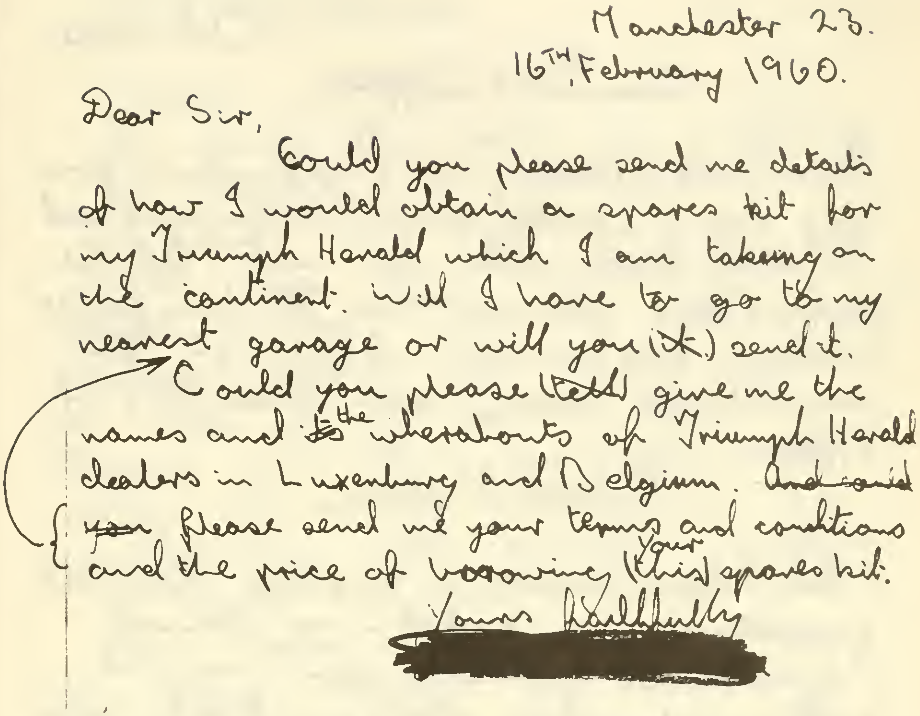
American influence on Britain in my opion is abominable. e.g. Chewing gum Big cars, and Jeans and Jean Jackets.

Chewing gum is a filthy discusting habit.

Large cars are ridiculous. You don't need them. An ordinary plain, simple, small car is all you need!

Jeans and jean jackets look (still) scruffy untidy. You look as if your just going down the coal mines, but we British are silly enough to take notice of anybody.

Americans tend to make their children little idols. Which in my opinion is wrong.



Manchester 23.
16th, February 1960.

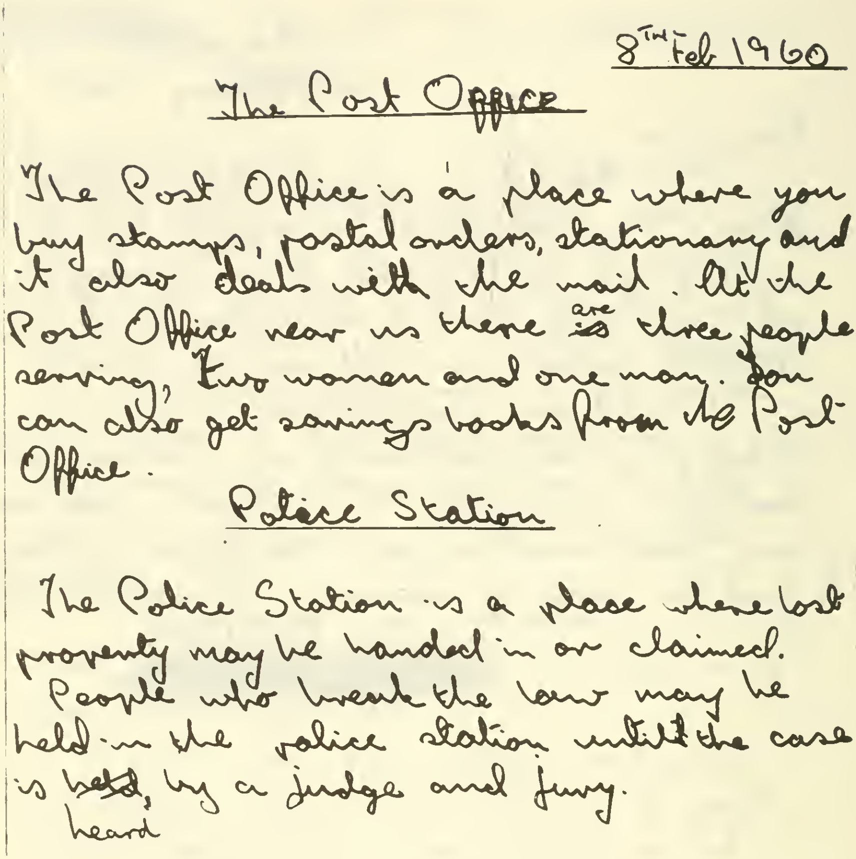
Dear Sir,

Could you please send me details of how I would obtain a spares kit for my Triumph Herald which I am taking on the continent. Will I have to go to my nearest garage or will you (~~it~~) send it.

Could you please (~~tell~~) give me the names and ~~its~~ the wherabouts of Triumph Herald dealers in Luxenburg and Belgium. ~~And could you~~ please send me your terms and conditions and the price of borrowing your (this) spares kit.

Yours faithfully

[redacted]



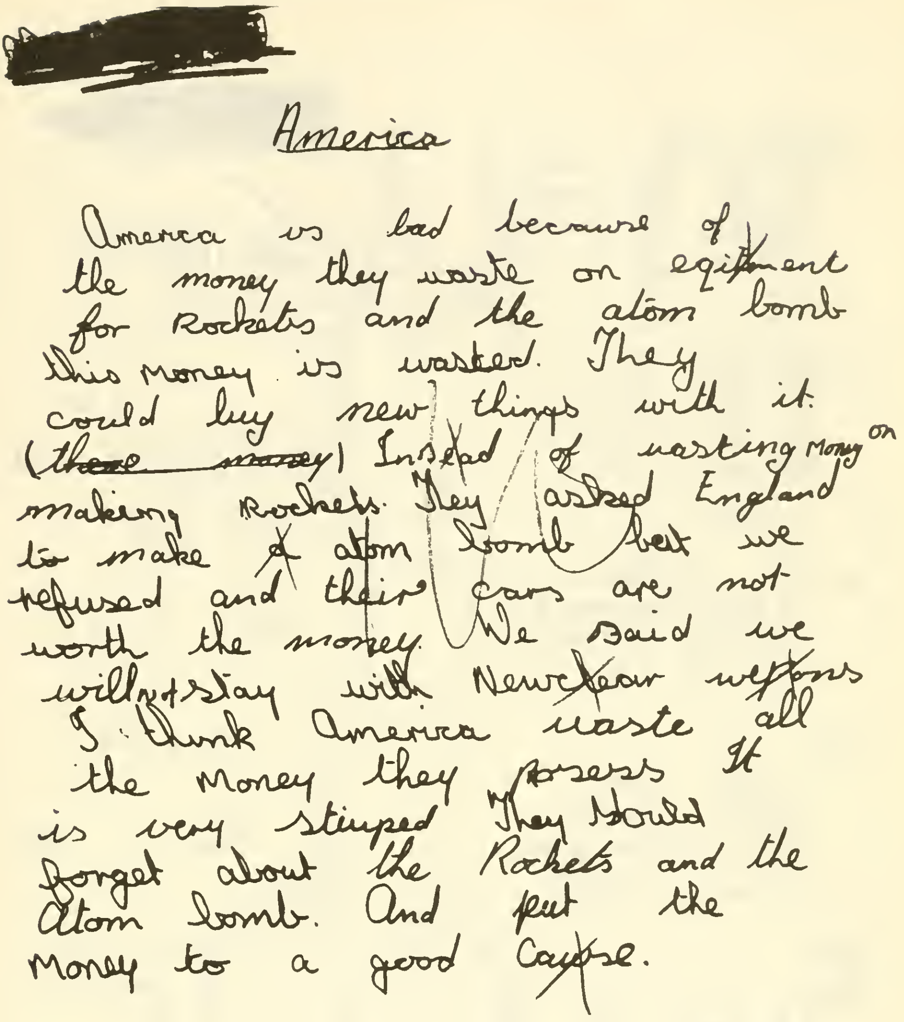
8TH Feb 1960

The Post Office

The Post Office is a place where you buy stamps, postal orders, stationary and it also deals with the mail. At the Post Office near us there ~~is~~ are three people serving, Two women and one man. You can also get savings books from the Post Office.

Police Station

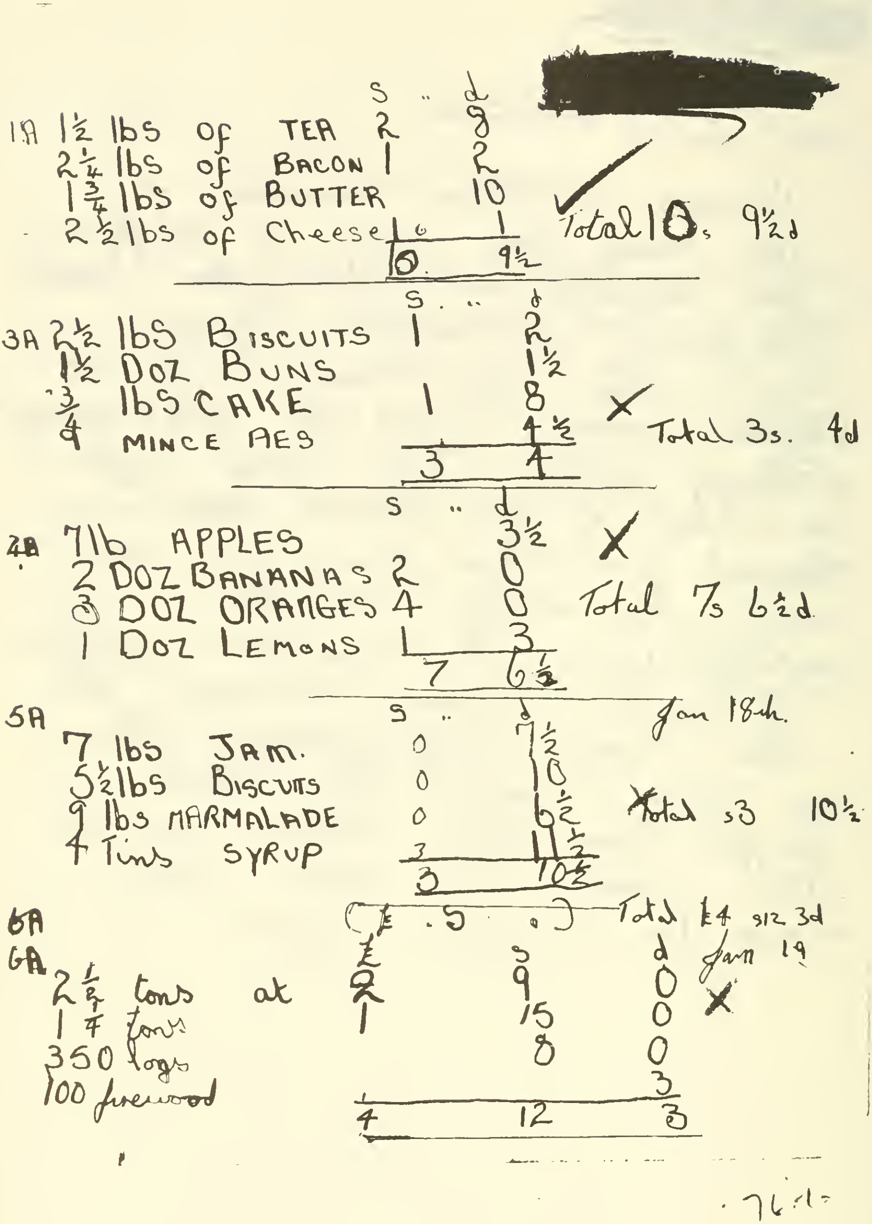
The Police Station is a place where lost property may be handed in or claimed. People who break the law may be held in the police station untill the case is ~~held~~ heard by a judge and jury.



[redacted]

America

America is bad because of
the money they waste on eqitment
for Rockets and the atom bomb
this money is wasted. They
could buy new things with it.
(~~these money~~) Instead of wasting money on
making Rockets. They asked England
to make ~~A~~ atom bomb but we
refused and their cars are not
worth the money. We said we
will not stay with Newclear wepons
I think America waste all
the Money they posess It
is very stuped They should
forget about the Rockets and the
atom bomb. And put the
Money to a good Cause.



[redacted]

		s	d	
1A	1½ lbs of TEA	2	8	
	2¼ lbs of BACON	1	2	
	1¾ lbs of BUTTER		10	✓
	2½ lbs of Cheese	6	1	Total 10s. 9½d
		10.	9½	

		s	d	
3A	2½ lbs BISCUITS	1	2	
	1½ DOZ BUNS		1½	
	3/4 lbs CAKE	1	8	✗
	4 MINCE PIES		4½	Total 3s. 4d
		3	4	

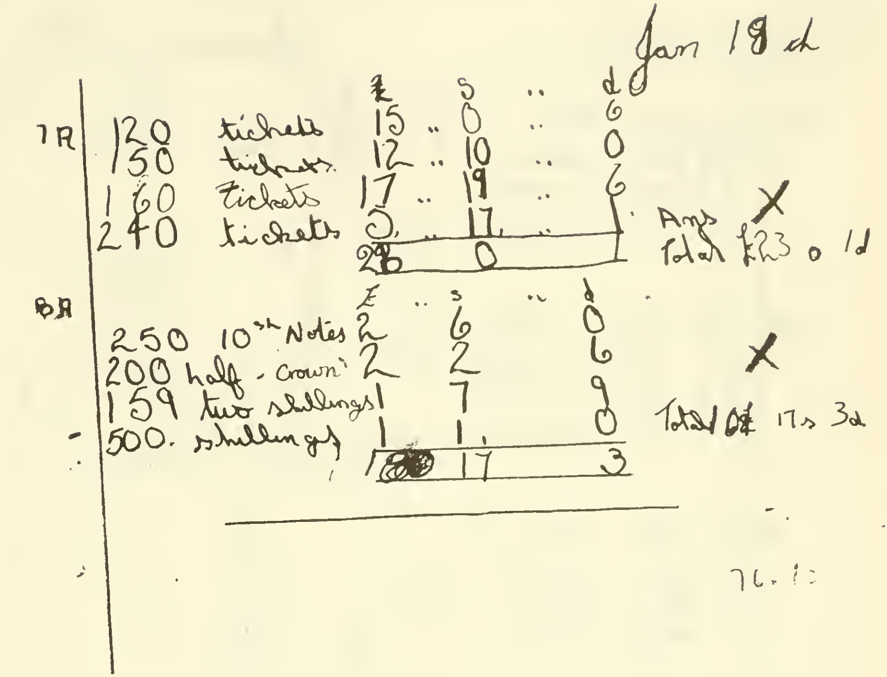
		s	d	
4A	7lb APPLES		3½	✗
	2 DOZ BANANAS	2	0	
	3 DOZ ORANGES	4	0	Total 7s 6½d
	1 DOZ LEMONS	1	3	
		7	6½	

		s	d	
5A				Jan 18th.
	7 lbs JAM.	0	7½	
	5½lbs BISCUITS	0	10	
	9 lbs MARMALADE	0	6½	✗ Total s3 10½
	4 Tins SYRUP	3	11½	
		3	10½	

6A (£ . s . d) Total £4 s12 3d

		£	s	d	
6A	2½ tons at	2	9	0	Jan 19 ✗
	1 ¼ tons	1	15	0	
	350 logs		8	0	
	100 firewood			3	
		4	12	3	

·76·1=



Jan 18th

7 R		£	s	d
120	tickets	15	0	6
150	tickets	12	10	0
160	tickets	17	19	6
240	tickets	3	17	1
		26	0	1

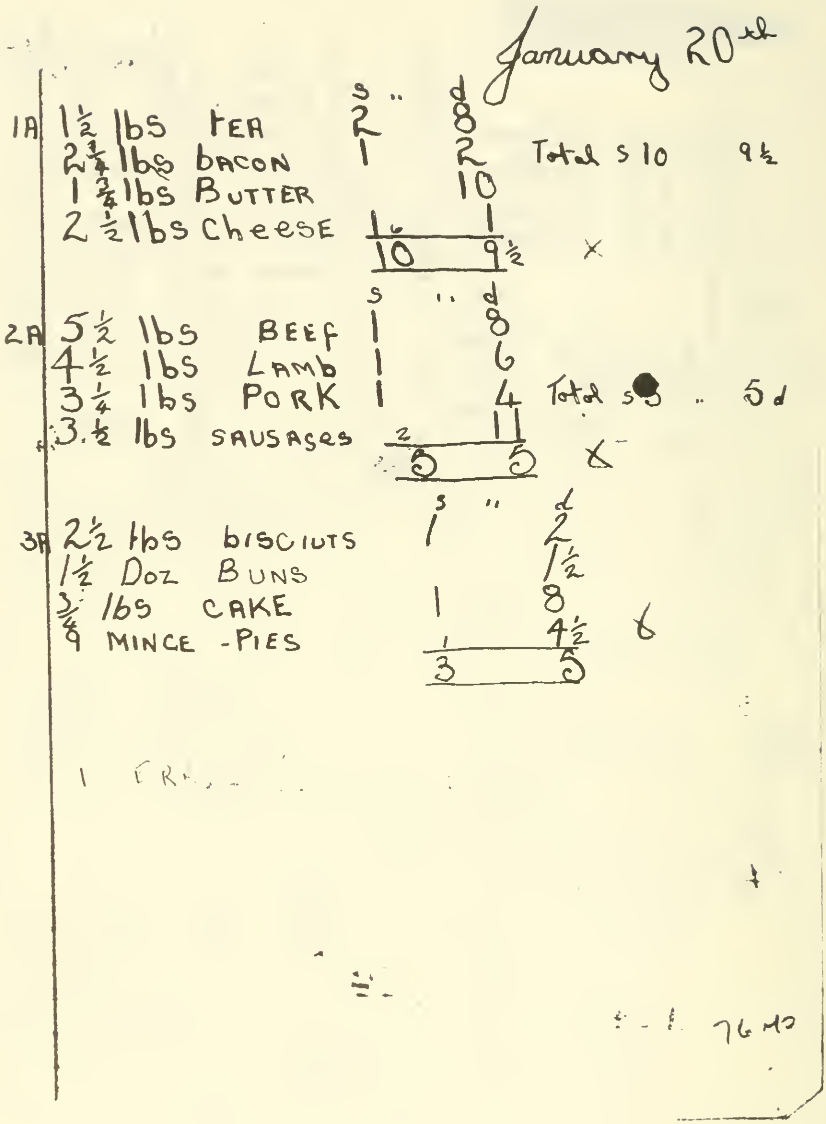
Ans X
Total £23 0 1d

8 A	£	s	d
250 10sh Notes	2	6	0
200 half-crown	2	2	6
159 two shillings	1	7	9
500 shillings	1	1	0
	[illegible]	17	3

X

Total ~~0£~~ 17s 3d

76 . 12



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	2½ lbs Cheese	1	1	
		10	9½	x

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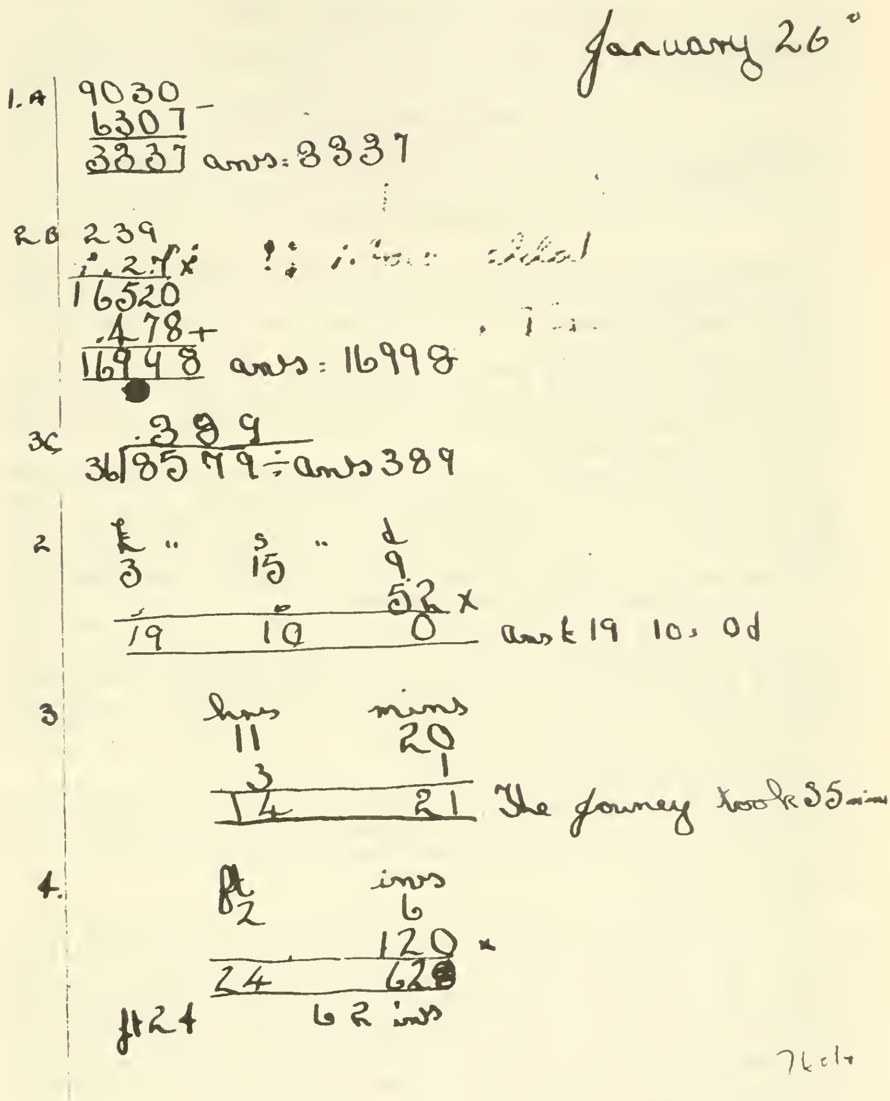
2A	5½ lbs BEEF	1	8	
	4½ lbs LAMB	1	6	
	3¼ lbs PORK	1	4	Total s 5 .. 5 d
	3½ lbs SAUSAGES		11	
		5	5	x

		s "	d	
3A	2½ lbs bISCIUTS	1	2	
	1½ DOZ BUNS		1½	
	¾ lbs CAKE	1	8	
	9 MINCE-PIES		4½	6
		3	5	



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ANNEX 3

SAMPLES OF PAPERS HANDED IN BY AMERICAN HIGH SCHOOL STUDENTS

Ladies' Home Journal, February 1959

(Author's comment: Notice the work sample on history of the pupil who is preparing to become a teacher)

IS THIS AMERICAN EDUCATION?

IF YOU FIND IT DIFFICULT TO IMAGINE HIGH SCHOOL STUDENTS WHO HAVE NOT LEARNED TO READ OR WRITE, THESE EXAMPLES WILL HELP YOU

(By Theodore Guerin)

Reproduced on these pages are examples of written work of high school students. I have hundreds of similar papers that I have collected in high schools in which I have taught and from teachers in other high schools. When I show them to my neighbors, they are amazed. But another teacher is likely to say, "Why, I have worse on my desk right now!"

My purpose in publishing these is to pinpoint the fact that not all children are born intellectually equal, and that no teacher can be expected to bring the 20 or 40 pupils in a classroom to an equal degree of accomplishment. The attempt to create this intellectual make-believe has relegated the American educational system to its present backwater.

You, the parent reading this, may feel removed from the situation because your child is doing well in school—or getting high marks, at any rate. Don't let those high marks influence you unduly, especially if you hope to send your boy or girl to college. Your child may be doing well only by comparison. To excel in some schools requires only mediocre work. Imagine the confusion of a young student of the sciences, or any college-level subject, if he comprehends the printed word only vaguely and cannot write simple sentences.

In many instances the education of our most able boys and girls is sacrificed because high schools provide courses watered down to suit the least able. Those who might be good students, finding the work too easy, fall into the habit of daydreaming instead of studying. They become the class cutups, or, more commonly, they pass desultorily through school with barely passing marks and become members of that not-so-select group—the gifted who give up learning, who do not go to college or develop their talents in any way. Their usefulness to themselves, and to all of us, is impaired or wholly lost.

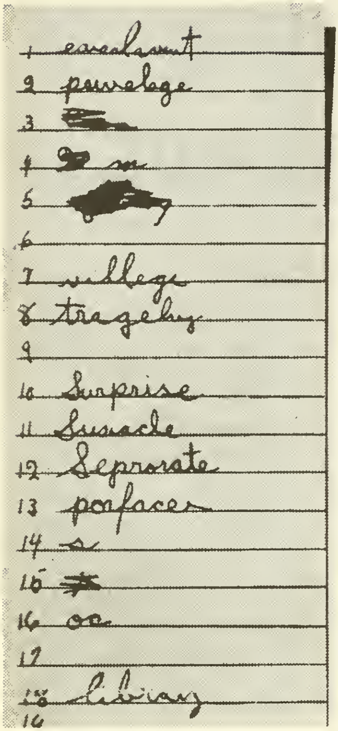
Most teachers are equally sympathetic to all the children they teach, but the slow learners almost surely make greater demands on their time. A teacher of the basic skills cannot gear the progress of an entire class to the advancement of the brighter students. He can and must spend extra time with the slow learners to bring them a point of comprehension that will enable the class to move on to more advanced material.

The brighter students are left to their own devices or given extra work. This serves well enough if the student is self-motivated and comes equipped with a built-in urge for education. But it is an exceptional youth who can drive himself to make this effort without the competition and support of other keen young minds. One reason often given for teaching children of widely varying abilities in the same classroom is that separating the slow learners from the fast would damage their personalities. Surely it is just as damaging, if not more so, to be one of the slow in a class of mixed abilities. With a group of children more nearly equal in ability, the class is able to move steadily ahead. Neither the slow nor the fast learner is so prominently marked—and hampered or hurt.

The boys and girls who produced these papers will be replaced in the classrooms by more just like them—bewildered, inept children, uneasy in a school situation that is as cruel as physical torture. Though some make little effort to help themselves, others try vainly to keep up with their classmates. Reluctant to place the stigma of failure on such children, unhappy teachers will pass them on to graduation. This is a distortion of the idea of "democracy in education." Truly democratic education would not expose all students to the same subject matter but would allow each to develop as much as he is able.

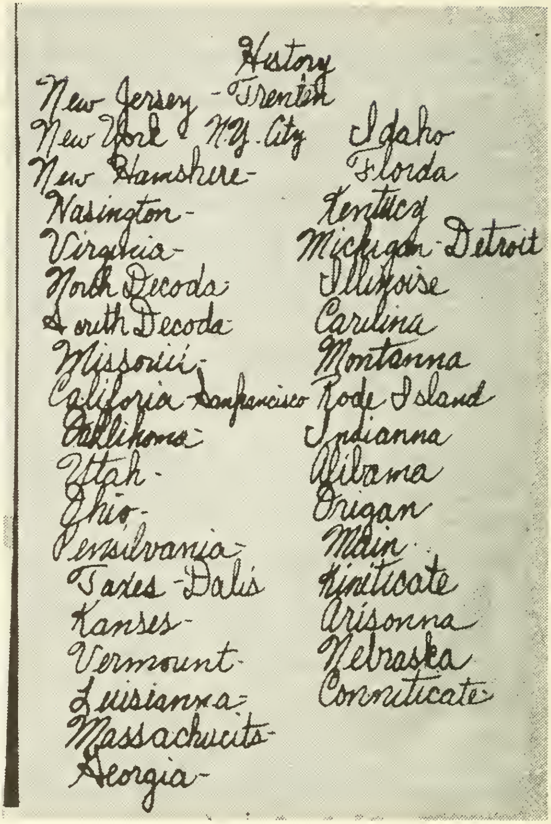
Many of these students have the basic intelligence, but they have not developed the specific skills. This is one of the reasons that about 45 percent of those who enroll in college do not graduate. The percentage of dropouts is very nearly as great in high schools. To bring this fact graphically into the open may be the first step in correcting some of the misconceptions that have made a bedlam of intellectual training in the United States.

Part of the solution to the present dilemma in education is the establishment of higher standards for able students, more honors and awards for academic excellence and realistic grouping of pupils according to their abilities. Probably most important in assisting teachers to eliminate schoolwork as bad as that shown here is the willingness of parents to recognize the degree of their own child's ability.



1 excelaunt
2 puwelege
3 [illegible]
4 [illegible]
5 [illegible]
6
7 willege
8 tragely
9
10 Surprise
11 Sumacle
12 Seprorate
13 porfacer
14 [illegible]
15 [illegible]
16 oo
17
18 libiary
16

One example, among many, of a spelling quiz given to a senior in high school. This pupil was graduated and is now employed in a store owned by his father.

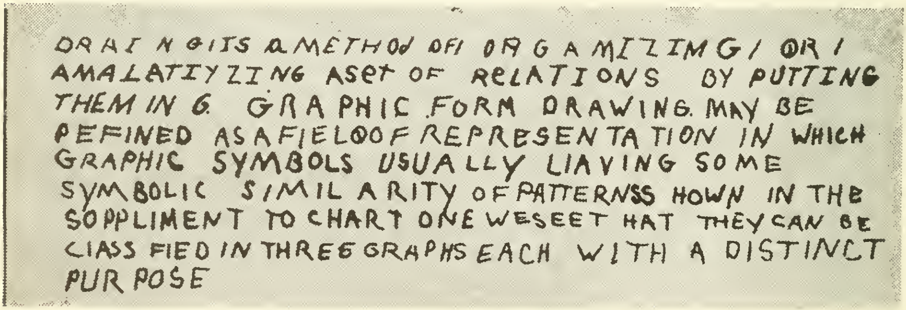


History

New Jersey - Trenten
New York N.Y. City
New Hamshire-
Wasington-
Virgaia-
North Decoda-
South Decoda-
Missouii-
California-Sanfrancisco
Oallikoma-
Utah-
Ohio-
Pensilvania-
Taxes-Dalis
Kanses-
Vermount-
Luisianna-
Massachucits-
Georgia-

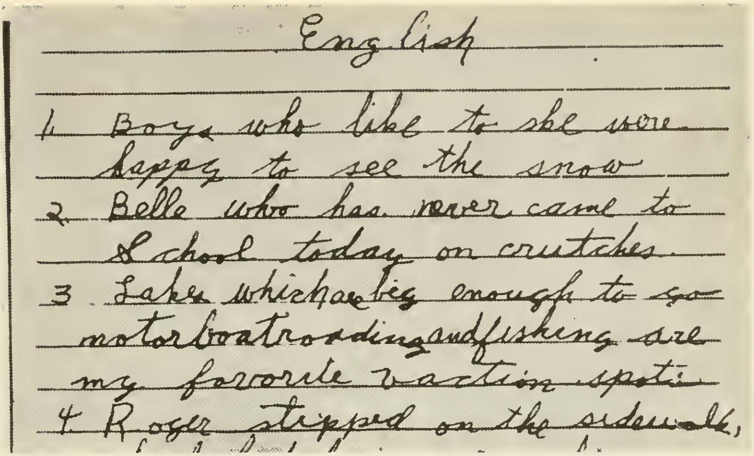
Idaho
Florda
Kentucy
Michigan-Detroit
Illinoise
Carulina
Montanna
Rode Island
Indianna
Alibama
Origan
Main
Kiniticate
Arisonna
Nebraska
Conniticate

Can you find your State on this list? Learning to spell the names of the States correctly was an assignment in a senior history class. This pupil was graduated from high school in 1956. He is now in college preparing to become a teacher.



DRAI N GITS A METHOD OFI ORGAMIZIMG/ OR/
AMALATIYZING ASET OF RELATIONS BY PUTTING
THEM IN 6. GRAPHIC .FORM DRAWING. MAY BE
PEFINED ASAFIELDOF REPRESENTATION IN WHICH
GRAPHIC SYMBOLS USUALLY LIAVING SOME
SYMBOLIC SIMIL ARITY OF PATTERNSS HOWN IN THE
SOPPLIMENT TO CHART ONE WESEET HAT THEY CAN BE
CIASS FIED IN THREE GRAPHS EACH WITH A DISTINCT
PUR POSE

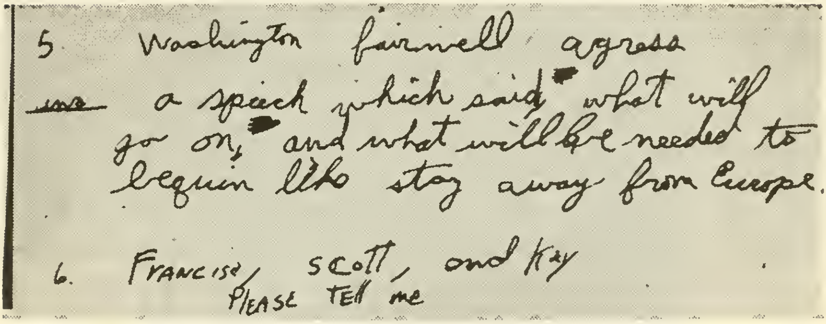
This lettering was done in a class in mechanical drawing. The boy was copying directly from his workbook. He dropped out of high school in his junior year.



English

1 Boys who like to ske were
happy to see the snow
2 Belle who has never came to
School today on crutches.
3 Lakes whichare big enough to go
motorboatroadingandfishing are
my favorite vaction spots.
4 Roger slipped on the sidewalk,

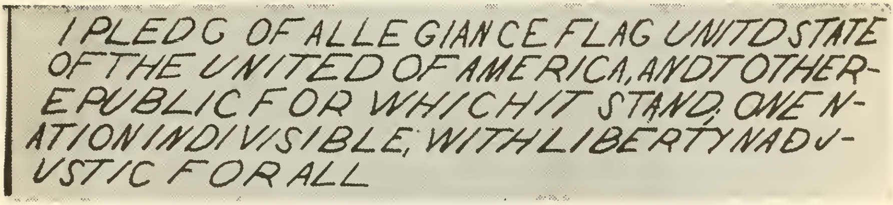
This paper was produced in a high school class studying grammar. The assignment was to copy sentences from a textbook, filling in the proper form of the relative pronoun *who* or *which.*



5 Washington fairwell agress
wa a spiech which said "what will
go on," and what will be needed to
bequin like stay away from Europe.

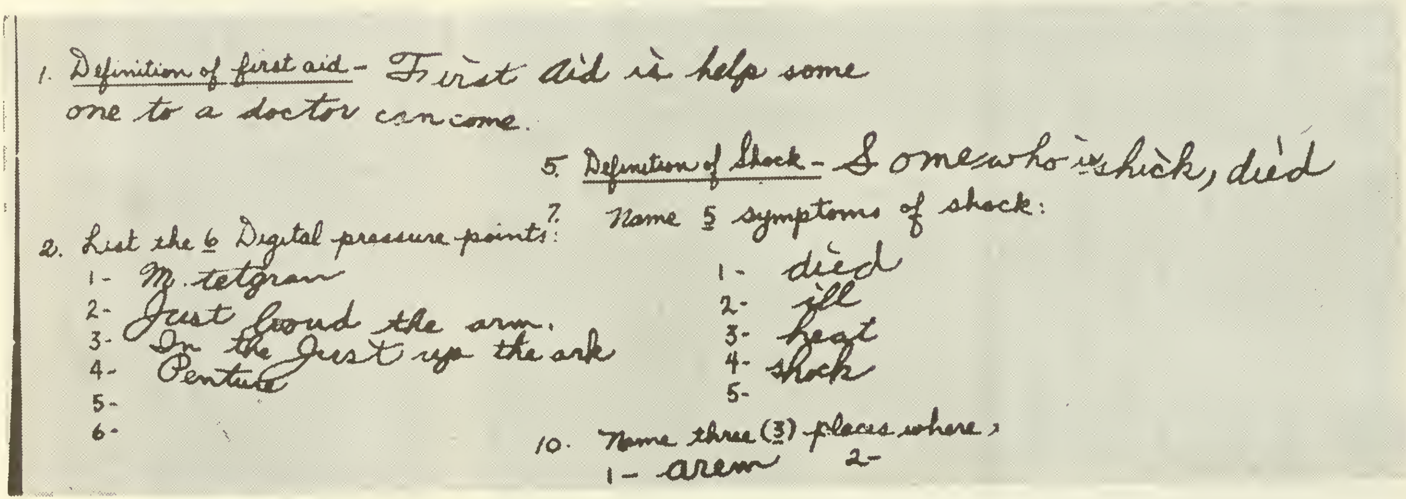
6. FRANCISE, SCOTT, and Key
PLEASE TELL me

Above is a portion from a junior history test. The pupil is now a senior and working part time. The teacher did explain again about Francis Scott Key.



I PLEDG OF ALLEGIANCE FLAG UNITDSTATE
OF THE UNITED OF AMERICA, ANDT OTHER-
EPUBLIC FOR WHICH IT STAND, ONE N-
ATION INDIVISIBLE, WITH LIBERTY NAD J-
USTIC FOR ALL

This lettering of the Pledge of Allegiance was copied from a workbook by a sophomore in mechanical-drawing class. Still a sophomore, he quit high school in his third year.



1. Definition of first aid - First aid is help some one to a doctor can come.

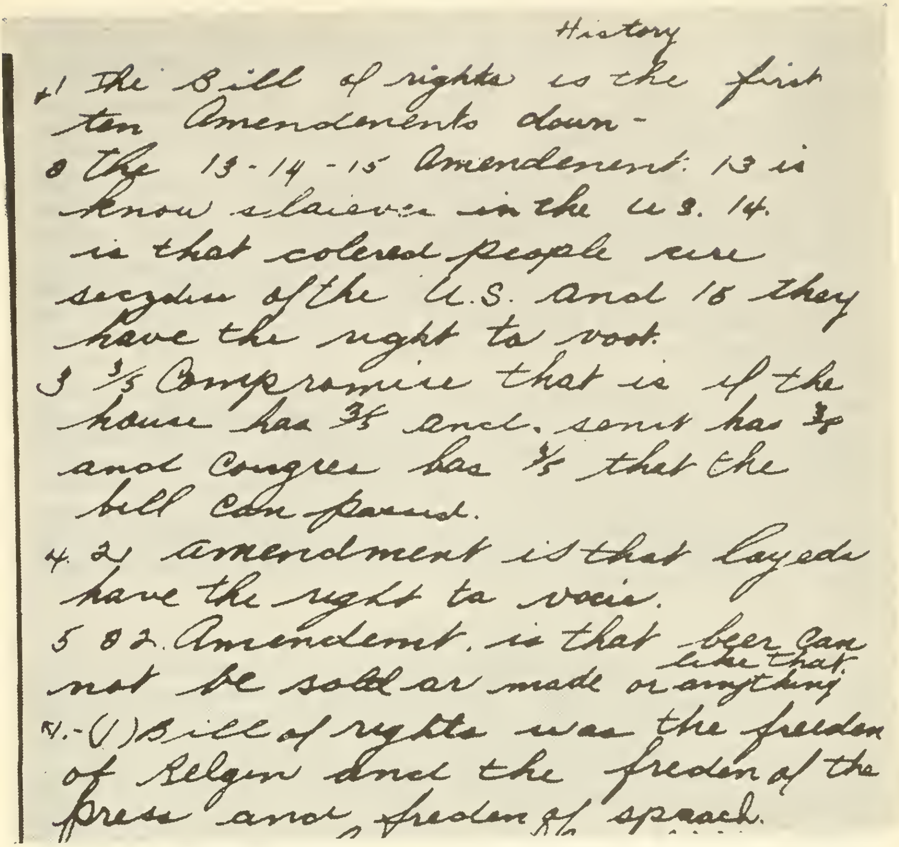
5. Definition of Shock - Somewho is hick, died

2. List the 6 Digital pressure points:
1- M. tetgran
2- Just bound the arm.
3- In the Just up the ark
4- Penture
5-
6-

7. Name 5 symptoms of shock:
1- died
2- ill
3- heat
4- shock
5-

10. Name three (3) places where,
1- arem 2-

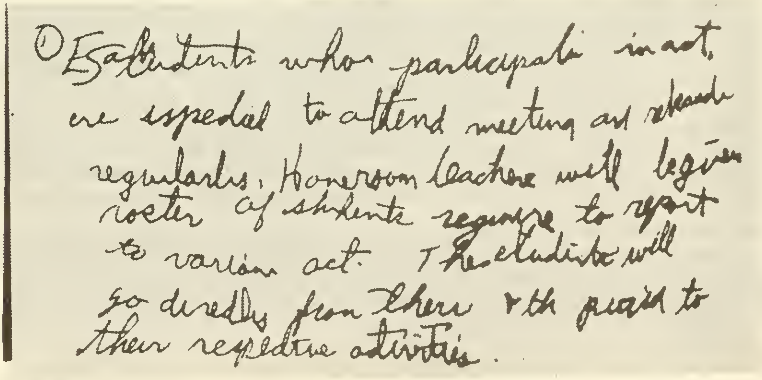
This is one pupil's reply to part of a test covering a unit on first aid given in a class studying health. The confused youngster quit high school at the beginning of the junior year.



History

+1 The Bill of rights is the first
ten Amendements down-
2 The 13-14-15 Amendement: 13 is
know slaiever in the U.S. 14.
is that colered people are
sezzden of the U.S. and 15 they
have the right to voot.
3 3/5 Compramise that is if the
house has 3/5 and. senit has 3/5
and Congree has 3/5 that the
bill can passed.
4. 21 amendment is that layeds
have the right to vocie.
5 82. Amendemt. is that beer can
not be sold or made or anything like that.
4.-(1) Bill of rights was the freedon
of Relgin and the fredon of the
press and fredom of spaach.

This example is part of a history test covering the Bill of Rights. The writer is a high school junior majoring in home economics.



① Estudents who parlicapati in act.
are espedial to attend meeting and rheasle
regularlis, Homeroom teachers will be given
roster of students require to report
to varlion act. These students will
go diredly from there & th peaid to
their repedtive activties.

This writing was copied from a book as "punishment work" in 1956 by a high school sophomore enrolled in a college-preparatory course. He was graduated in 1958.

ANNEX 4

[From Chemical and Engineering News, Nov. 21, 1960]

EDUCATION

HIGH SCHOOL STUDENTS CAN'T WRITE OR SPELL—PROJECT TALENT FINDS THAT ONLY ONE IN 100 U.S. HIGH SCHOOL STUDENTS CAN WRITE A PARAGRAPH OF PERFECT ENGLISH

Computers at the University of Pittsburgh have started to grind out facts about the U.S. high school population—its characteristics, aptitudes, abilities. And one of their first judgments confirms a deficiency long suspected: Johnny can't write; neither can Mary.

Specifically, the early studies reveal that only one high school student in 100 can write a five-minute theme without making mechanical mistakes in English. Their gross errors in usage are shocking, says Dr. William A. Gorham, supervisor of test administration for Project Talent. Further, high school boys, on the average, misspell one word per theme, compared to girls, who misspell one word in two themes.

Project Talent is the research program that expects to pin down enough information on American youth to give a useful inventory of the nation's human resources of the future (C&EN, March 2, 1959, page 154). It is directed by Dr. John C. Flanagan of the University of Pittsburgh and supported by the U.S. Office of Education, the National Institute of Mental Health, and the Office of Naval Research.

Currently, Dr. Gorham says, the 2,000 bits of information collected last spring from each of 450,000 high school students (1,357 schools) are now in the computers. The machines will be divulging answers in the future as fast as Project Talent can pose its questions.

REVEALING THEMES

As part of Project Talent's two-day testing process, all students wrote for five minutes on each of two themes: "My Views About an Ideal Occupation" and "What High School Means to Me." A random sample of these themes may seem amusing at first reading, Dr. Gorham says. But, amusement quickly gives way to shock as the quality of the product of U.S. high schools becomes apparent.

In spite of technical errors, Dr. Gorham believes, the content of the themes will provide a rich source of insights into the attitudes, values, and plans of young people. He predicts that the content of themes written by different groups of students will turn up some interesting comments on the attitudes and needs of people who turn out to be successful or unsuccessful; to be secretaries or physicists; to be social workers or inmates of institutions.

BOYS VS. GIRLS

Project Talent, in its preliminary data, has already questioned some of the differences that people accept as inherent in boys and girls, according to Dr. Gorham. One such concept says that for some genetic reason women have less aptitude than men for mathematics. This reasoning is advanced, Dr. Gorham points out, to rule women out of science and engineering.

But, Project Talent finds little difference in the male and female potential for learning math. By the time today's students reach grade 12, Dr. Gorham explains, it is true that, on the average, girls know about 70% of what boys know about math. This figure reflects their knowledge of terms encountered at all levels of math. And boys do take more math courses than girls, who steer away from them.

The logic of the concept goes on to say that since girls are poorer in math, they compensate by being better in English, Dr. Gorham adds. Here again, Project Talent shows no valid reason for continuing to think in terms of the boy-girl/mathematics-English concept. The girls do a bit better in spelling, grammar, punctuation, capitalization, and usage. But the boys come through with larger vocabularies.

"Ideal Occupation" themes written by high school students show their lack of writing skills:

BOYS

"My Idea of a ideal occupation is working on a large constraction gang. Maik a lot of money and do what you please, with it is my idea of a perfect job."

"My plans for life after high school is to go to the Army for a few years, and after I come out of the Army I would like to become Engineer."

"one in which I could earn a good pay, to provide for my family if I have one. To pay my bills and job which provides a type of work I like to do and am interested in, and able to do."

"I would like to have a job where I could travel a lot and steal be at home every night."

GIRLS

"My view about an ideal occupation would be very good. It would help me to started right after I finishe high school. I will not have any troubled getting in to any occupation when I finish high school."

"I would like to be a professional where I could meet all types of people. Mostly I want to be rather commercial sort of professional. I would like very much to be a certified public accountant, secretary or office clerk."

"I would like to work in a hospital taking care of children or working with an orphinage. I also would like to be a Airline Stearest. It would be very excitting."

ANNEX 5

SAMPLE OF COMPOSITIONS BY AMERICAN ELEMENTARY AND SECONDARY SCHOOL TEACHERS IN REFRESHER COURSE AT A LARGE MIDWESTERN UNIVERSITY

[Harper's Magazine, November 1954]

CAN OUR TEACHERS READ AND WRITE?

(By James D. Koerner)

Twenty-eight teacher-students in an extension course in American literature became a nightmare problem to their unhappy professor. How illiterate can you be, he wondered, and go on teaching in our public schools? Here is his line-by-line review of the evidence.

There has long been a suspicion in university circles that a large number of teachers in our primary and secondary schools are totally incompetent for the job. Generally, this suspicion has remained just that, because most college teachers have no opportunity for first hand observation, because proof is difficult under any circumstances, and because the whole subject is a delicate one. However, to my own astonishment, I have recently turned up a great deal of specific evidence to support the fears of the colleges.

As a teacher in a large Midwestern university, I was asked last February if I would teach an extension course in American literature to twenty-eight primary and secondary school teachers from around the state who were required to maintain their qualification records with regular work of this sort. Such an adult and professional group promised to be stimulating and I took the job. But when we got started on the weekly meetings of two and one-half hours each, and I began to read the brief papers that the students handed in, I suffered misgiving, disbelief, shock, horror, wrath, and apathy—in something like that order. For in the broad sense of the word, these men and women were downright, hopelessly illiterate.

After a serene initial meeting which gave no hint of what was to follow, I determined to make the material and the conduct of the class the same as in the regular undergraduate courses at the university. I also adopted a teaching device that I had found effective with freshman and sophomore students: giving out each week a set of questions of graduated difficulty that allowed the student to pick his own level, that could be answered in a few minutes, and that showed up how much each person had got on his own hook from the reading assignments.

The first papers happened to be on Mark Twain, and they went like this:

"He explained how, although Huck's actuall experiences and doings were quite outwardly boyish and mischeivious through his inward thoughts and reasoning the author conveyed to the reader, although Huck didn't realize it himself, he knew the difference between right and wrong."

[Or like this:] "Huck did not have harsh feelings of anyone—His consicense bother him oftens but he over came it by getting it off his chest whatever bother him. It told the truth of a boy who had trial and troubles but it seem to me it never bog him down."

[And this:] "One particular instanse as he was apparently moving over its brown muddy water, when traveling with Jim toward the Ohio, and freedom for Jim, he felt his conviction of doing wrong according to law, but in each instanse the affairs & business of transportation seem always to create a change of such thoughts until he decided it knew best so why not let events take its course."

Other papers were studded with phrases like "these mens pranks," "not an disillusionment," "would of acted," "his fathers name," and "his prestege over any one elses." I am quoting these passages exactly as they appeared on the page, changing nothing.

At the following week's meeting I delivered myself of a stirring pronouncement on standards. My students took heed and were genuinely frightened. I asked them to hand me brief statements about themselves from which I learned that most of the twenty-eight had had a considerable amount of college work from institutions around the state and elsewhere, but only a few had finished college; most were primary teachers, teaching several different grades; and almost all of them taught English as one of their subjects. Some had taught thirty years, some two or three, the average for the group being about ten. All were native born, had no language problem, as such, and taught in schools that varied from one-room rurals to city schools of about a thousand students. The most illiterate eight or nine, I noted, were employed in the larger city schools, usually teaching the upper primary grades.

When I got to the second week's papers, I realized that any talk about standards was useless because the problem was not, as I had hoped, one of carelessness; but, as I had feared, one of ignorance. Choosing more or less at random from the second lot and the remaining weeks' papers, written on a number of different topics, I find a plethora of statements (each from a different teacher) like the following: "* * * he ran away supposidly to New Mexico"; "Antonia left Nebraska because she was in love with this man. They say people in love are blind and this I somewhat think sort of proves it"; "She returned home pregnate and had a girl at her old home she later married and had a large family"; "She was happy because she had a fine family, a good stabel home, and live where she had lost her father who she worshiped"; "These human experiences show—plainly the hardships and failurs of individuals in the 1880's. Their achievment or goodness and fulfilment to overcome these experiences."

Perhaps you recognize what these writers were driving at better than I did: "* * * he seems much more mature having met many crisis such as the demerits the plane crashing on the Cain when the captain jumped etc."; "Rubashov signs the confession and declares himself after this endless mentally abusement"; "The relationship between his cell mates practically shows the uselessness of his cause—an an anti-rautionist ['Revolutionist;' I assume, or perhaps 'Russianist']"; "Ivanov was a buddy of Rubashov they grew up together were in college together & members of the same previous click"; "The controversary over the 'Grapes of Wrath' is an example. O'Neils work is another example"; "He seems to have a perfect understanding of humans and likes to dwells on the gamulet of emotions"; "He writes in a very plain spoken way saying things as they are. He is not afraid to call a spade to use a slang phrase"; "Naturalism came into the short stories at the turn of the century. It picks out moral creation of characters envirement"; "Romanticism has ideals he upholds and writes how he would want it"; "That is one thing a great many present day books do. They are to phycological—to much above the average readers head. They become obssessed with one idea and go to far."

And finally, just to illustrate the way in which my thoughts occasionally come back to me with, as Emerson has it, "a certain alienated majesty": "Hemingway works is the beginning of all modern American Literature. He doesn't write too much conversation in his books. Just enough to make the idea go across and his discriptions are brief with many adverbs."

I could go on. Perhaps the above examples illustrate well enough the average kind of problem in grammar, spelling, and punctuation that characterized the class. But beyond the mere mechanics of communication loomed the all but insurmountable obstacle of communicating the simplest literary idea. Consider, for example, the following passages taken from the final examinations and from the reports written *outside* of class. Again I choose pretty much at random (there are, that is, half a hundred more which I could exhibit of the same quality):

"In using images on a screen reflects the value of vivid and true expression needed to move and audience emotionally. This play give a clear picture of the mothers memory of youthful romance. The character Jim and Laura illustrate the value of two who had similar experiences: but Lauras whose self concionious was placed more vivid on the screen." [*The Glass Menagerie.*]

"The power of O'Niel seems to be his skill of stage affects which give added effect to the spoken word * * * In the character of the Emperor in the woods, the use of Tom toms coming closer. Visions and supposed visions of Joneses dealings in the chain gang led the actor to relive Jones feelings of the actual time. It cast a spell over Jones so that he feels cant express myself here."

"The stronger voice is showing the events that has happened in his life. Charts and diagrams of all the good and bad things in life he did with special emphasis on their totals with some extractions. * * * He was place in this large court room or decision room where all cases were pronounced. The leader was giving the long lost lecture. Most of the time was silent but applause was heard at intervals probably to better their record of life." [Whitman's "When I Heard the Learn'd Astronomer."]

"America was a new country. Nothing of culture existed. The prime interest of the people who came here was establishing of a home or they were runners away from injustices in Europe. (Not entirely but as a whole) There was writing in America before the Civil War and many good ones, but their work is either biographic or historic and contained nothing new * * * The best of this group of verses is "The Song of Myself," in which he places himself as the leave of grass * * * In 1920 [the author was old enough to have lived through the First World War as an adult] America was plunged into a European war. Not much literature developed during the war. America had not experienced many social adjustments and the works of this period were not outstanding except to tell a few war anticdotes."

Ad infinitum. I think that there was no error of grammar or mechanics, of organization or general composition, that was not perpetrated by this class of teachers, not once, but many times, and despite repeated corrections. Syntactically their papers were a chaos, the punctuation a farce, the spelling a grim joke. As further examples of the last, consider such spellings as *emensly*—*immencely*—*accidently*—*imprisoment*—*controll*—*immagined*—*immegrants*—*symobols*—*tence*—*oblidged*—*suceed*—*relialable*—*executation*—*ciper*—*occurr*—*factional* (for fictional)—*dramits* (for dramatists)—*gilt* (for guilt)—*reliefed* (for relieved)—and *harmous* (for harmonious).

As for the other details of the class, the discussions, and the subjective conclusion and intangibles that remain after any course: I leave all that to the reader's imagination. I confine myself to the facts, the most obvious of which is that these twenty-eight teachers could not communicate in the English language. And, as should be equally obvious, my intention is not to malign or discredit this particular group, all of whom were sincere people and most of whom were desirous of doing whatever was in their power about their professional shortcomings. I wish mostly to pose the question: How widespread in the teaching profession is the kind of illiteracy revealed here—and what can be done about it? Perhaps my experience is an isolated one. I doubt it: with reason. I suspect that it is duplicated many times each year around the country.

If someone were to ask me, and someone has, the nastiest question of all: What did *you* do about it?—I would beg him to remember, among other things, that these teachers either pass such courses or change professions, an event that would be disastrous for their private lives.

I passed 'em. What would you have done?

ANNEX 6

BRITISH INFORMATION SERVICES

AN AGENCY OF THE BRITISH GOVERNMENT

REFERENCE AND LIBRARY DIVISION

July 1961. ID 1312

SELECTION FOR SECONDARY EDUCATION IN ENGLAND AND WALES

Sample of Questions Typical of a Selection Examination (11 plus)

ENGLISH

A. Typical subjects for an essay:
  1. The radio program you like best.
  2. The Bible story you like best.
  3. You are away on a holiday. Write a letter home.
  4. An adventure.
  5. Climbing mountains.

B. Here are some questions from a general paper:
  1. Underline the correct answer in each set of brackets in:
     (i) He arrived (to / two / too) late as the children had already (gone / went) to school.
     (ii) Perhaps this will (learn / teach / taught) both of (they / them) not to throw stones.
  2. Give the correct spelling of the underlined word with missing letters:
     (i) She heard the sound of merry l____ter
     (ii) He bought presents for his nieces and ne____ws
     (iii) Water is li__id
     (iv) The boy had stolen apples and was in d__sgr____
     (v) In church __s__ms are sung
  3. Underline the word nearest in meaning to the word printed in capitals:
     (i) Unfortunately she could not RECALL all the president's words. (understand / remember / pronounce / hear / read / reveal)
     (ii) Soon afterwards their TRUSTWORTHY servant died. (only / old / ailing / reliable / treacherous / last)
     (iii) She is AWKWARD in her movements. (quick / impulsive / beautiful / clumsy / charming / slow)
     (iv) We left London RELUCTANTLY. (gladly / obediently / unwillingly / readily / unluckily / for good)
     (v) The boat sailed on over the PLACID sea. (sparkling / calm / stormy / blue / choppy / wide)
  4. Forming adjectives from nouns:
     (i) MOUNTAIN......The waves were................
     (ii) PLEASURE.......Our holiday was a most.........one.
     (iii) SPAIN............Drake defeated the............fleet.
  5. Underline the words which rhyme with the given word:
     (i) THOUGH......(cough / thou / woe / tough / laugh / through)
     (ii) YOLK.........(look / smoke / yokel / bulk / walk / Yule)
     (iii) YACHT.......(raft / cracked / flashed / tact / got / match)
  6. Underline the word in brackets which has the same meaning as the given phrase:
     (i) A dog of mixed breed
     (dog-fish / pekinese / half-caste / mixture / mongrel / foxhound)
     (ii) The life-story of a man written by someone else.
     (novel / livery / serial / autobiography / history / biography)

7. Forming the plural from a given noun:
   (i) GOOSE......The..........waddle down to the river.
   (ii) MAN-SERVANT......The Duke had..........only.
8. Passage to test the comprehension of what is read:

A GRACE FOR A CHILD

Here a little child I stand
Heaving up my either hand;
Cold as paddocks though they be,
Here I lift them up to Thee
For a benison to fall
On our meat and on us all.
Amen.

HERRICK

Underline the correct answer to the following:
(i) The child is speaking to (Herrick / his father / his mother / all / God)
(ii) The child holds up (his left hand / his right hand / neither hand / both hands / two little toads)
(iii) What is the meaning of "benison"?
(sauce / a kind of meat / blessing / rain / curse)

ARITHMETIC

A. Mechanical computation:

Multiply

869
7

Subtract

miles	fur.
6	3
4	7
miles	fur.

Add

lb.	oz.
5	3
12	8
6	9
lb.	oz.

Divide

tons	cwt.	
27	4	by 8

Multiply

yd.	ft.	in.
6	2	8
		7

Divide

£.	s.	d.
79	14	1 by 37

Subtract

st.	lb.	oz.
8	6	5
4	13	14

B. Problems:

(1) A tap leaks at the rate of 1 pint per hour. How many gallons are lost in one day?
........gallons

(2) A brick is 9 inches long. How long are 7 bricks laid end to end? Give the answer in feet and inches
........ft. ....in.

(3) What is the cost of 3 ounces of tobacco at 3s.8½d. an ounce?
........s. ....d.

(4) There are 37 boys in one class at school, and 34 in another class. If 10 of these boys were absent one day, how many would there be left in the two classes.
........boys

(5) If the length of my stride is 36 inches, how many strides do I take in half a mile?
........strides

(6) A book has 150 pages, with 40 lines to a page and 10 words to a line. How many words are there in the book?
........words

(7) A necklace of beads is 2½ feet long. If each bead is ¼ inch long, how many beads are there in the necklace?
........beads

TEST OF INTELLIGENCE

1. (i) Which letter occurs *least* often in the word PERPETRATE? (........)
   (ii) Vinegar is to Sour as Honey is to (sugar/comb/bee/sticky/sweet/yellow)
   (iii) Which of the following words has no two letters the same? (instruct/revision/orchestra/precious/ascertain/surmount)
   (iv) House is to Roof as Room is to (window/floor/ceiling/fireplace/chimney/wall)
   (v) If the letters in the word SPECIAL were rearranged so as to be in alphabetical order, which letter would then be in the middle? (........)
2. Opposites:
   (i) ALWAYS......(now/often/never/sometimes/ever/soon)
   (ii) VANISH.......(disguise/visible/shine/see/appear/hide)
3. Classifying:
   (i) SERVANT, VALET, BUTLER (invalid/master/nobleman/kitchen/waiter/service)
   (ii) HIVE, LAIR, BURROW (bee/thicket/nest/hide/tunnel/jungle)
4. After reading:

   Five men, whom we shall call A, B, C, D and E, each inhabit one floor of a five-storied house.
   B lives two floors above A and one floor below D.
   E lives one floor below A.

   Answer:
   (i) Who lives on the bottom floor? ....
   (ii) Who lives on the top floor? ....
   (iii) Who lives one floor up? ....
5. Order—underline the first and last:
   (i) First/sixth/fourth/tenth/third
   (ii) Walk/stroll/run/trot/stand
6. Code—the numbers correspond to alphabetical order:
   (i) (2, 9, 4) means..........(big/bit/aid/bid/bin/die)
   (ii) (19, 15, 21, 18) means..........(tour/soul/sour/rout/sown/smut)

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